LIBRARY

FEB 28 1928

RAW-HILL PUBLISHING COMPANY, INC. FEBRUARY 25, 1928 TWENTY-FIVE CENTS PER COPY

ENGINEERING AND
MINING JOURNAL

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

THE ANNUAL MEETING OF THE A.I.M.E.

Is Held in New York, with HERBERT C. HOOVER As Guest of Honor

THERMIC REDUCTION OF BOLIVIAN TIN CONCENTRATES

By C. G. FINK and C. L. MANTELL

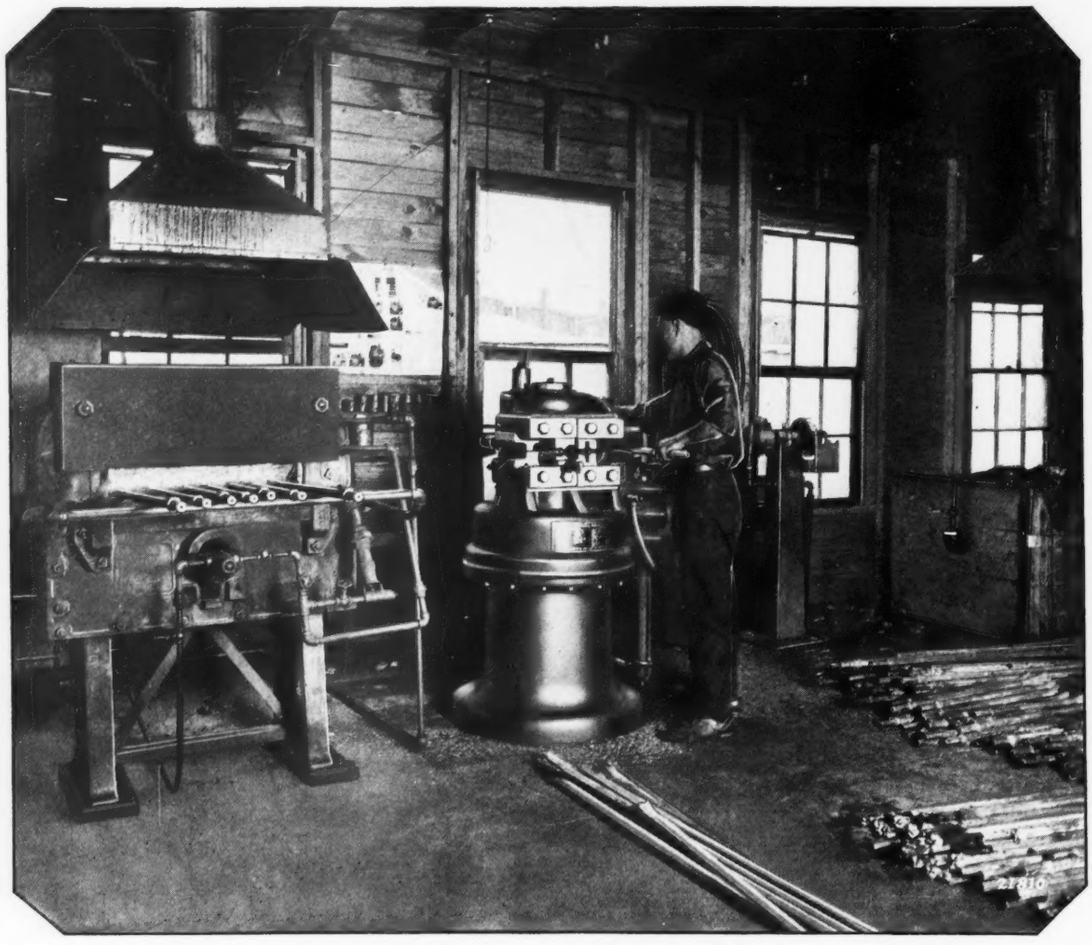
CRUSHING-ROLLS FOR ORE AND ROCK-II

By W. T. W. MILLER

WHAT DOES WESTERN TASMANIA HOLD FOR THE PROSPECTOR?

By PERCY O. LENNON

A REVIEW OF MINING AND METALLURGICAL EQUIPMENT



GIVE YOUR DRILLS A CHANCE—
use sharp steels

Give your drills a chance to really show what they can do; supply them with plenty of sharp steels and they will do their work faster, better, and cheaper.

"Leyner" Sharpeners turn out steels that are sharp and true to shape and size. They turn out quality steels on a quantity basis.

The "Leyner" Sharpener is designed with a heavy crosshead which travels through a short distance. This feature allows the operator to use either a quick, snappy blow, or a squeezing action, depending upon the work. It is a design that has given "Leyner" Sharpeners twenty years of world-wide leadership.

Bulletin 4422 is just out. Let us send you a free copy.

INGERSOLL-RAND COMPANY
11 BROADWAY NEW YORK CITY
Offices in principal cities the world over
For Canada Refer: Canadian Ingersoll-Rand Co., Limited
10 Phillips Square, Montreal, Quebec.

Ingersoll-Rand

ENGINEERING AND
MINING JOURNAL

McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, President

A. W. ALLEN,
Editor

VOLUME 125 — New York, February 25, 1928 — NUMBER 8

The Presidencies

AN ANNOUNCEMENT of significance to American industry and the American people was made recently—that Mr. Herbert C. Hoover, Secretary of Commerce, would accept a nomination for the Presidency of the United States. His appearance at the banquet of the A.I.M.E. on Tuesday last, when he received the Saunders gold medal, showed a mutual reciprocation of honors that reflected the national standing and prestige alike of Mr. Hoover and of the mining engineering profession, of which he will always remain, whether Secretary of Commerce or President of the United States, a distinguished member. Mr. Hoover has the loyal and hearty support of all engineers, as a professional tribute; and likewise of a multitude of those less fortunate citizens who are unable to gage his success in terms of engineering ability, but who realize the depth of his devotion to the great humane and administrative tasks that have claimed his attention and energies in recent years.

Mr. Hoover served as president of the A.I.M.E. in 1920. Again, this year, a distinguished government official receives that honor. Dr. George Otis Smith, director of the U. S. Geological Survey since 1907, is well fitted to follow in the footsteps of the many distinguished leaders in mining and metallurgy and geology who have preceded him. The high and uniform quality of the work done by the Survey during his occupancy of the directorate commands respect and a generous measure of approval, abroad as well as in the United States. Doctor Smith never compromises with his convictions, and has earned the esteem and affection of his associates and confrères.

To Mr. Hoover and to Doctor Smith it is fitting that *Mining Journal* should extend felicitations and good wishes for successful terms of office. That Mr. Hoover will be elected this year as Chief Executive is an outcome that will be doubted by no one with an appreciation of his fitness for the position and a knowledge of his professional and public service to the United States and the world at large.

The Hollinger Fire

DEEP SYMPATHY for the bereaved families of the thirty-nine men who went into the mine on Feb. 10, never to emerge alive, is the first reaction to the Hollinger fire. It is to be expected that, so far as money will serve, the losses will be compensated.

Next, one is compelled to ask: could the tragedy have been averted or its consequences mitigated if reasonable precaution had been exercised? After such a catastrophe it is generally easy to recognize that mistakes occurred and that neglect was evident. Unpleasant though it may be, and futile so far as the victims of the Hollinger fire are concerned, questions must be asked and answers given. Uncontradicted evidence shows that a large quantity of inflammable refuse was allowed to accumulate in the stopes. Was there any excuse for permitting the continued existence of such a hazard?

It appears from the reports that the nearest oxygen helmet was in Toronto; and that helmets available there were not suitable for the purpose required. Not until a mine rescue car from the Pittsburgh station of the U. S. Bureau of Mines had been rushed 900 miles to the Porcupine district was it possible to take effective measures to extinguish the fire. Even though the properties in the area may be classed as comparatively safe with respect to fire hazard, is it too much to expect that a mine that each year produces gold worth $15,000,000, and pays dividends of one-third that amount, should be equipped with standard apparatus used elsewhere for combating mine fires?

Other questions should be asked. What precautions are taken in the way of systematic patrol of the workings? What arrangements are made for giving imperative warning to miners in remote workings when it is necessary that they leave the mine? What provision is made for fighting an incipient blaze before it gains dangerous headway? Are adequate fire-doors provided to make possible the isolation of a fire within a small area? These and still other questions should be asked officials of the Hollinger mine and the government mine inspectors charged with the responsibility of compelling mine managers to protect the lives and health of their workers.

From a broader aspect the shock of this catastrophe should impel mine executives not only in Ontario but elsewhere to re-examine conditions at their own properties and to take drastic measures where unnecessary hazard is found to exist. Nothing will restore the lives of the miners who died in the Hollinger; but their fate should stir the mining industry to take every precaution to avert a repetition of such a tragedy. Six years ago, forty-seven men lost their lives in the Argonaut fire. Was the publicity given to that disaster by the technical press of no avail; or are lessons learned thus soon forgotton or ignored?

Harvard Awards Gold Medal to

JAMES H. McGRAW

For Distinguished Service to Industry

THE PRESIDENT of the company that publishes this journal, Mr. James H. McGraw, has been awarded a gold medal by Harvard University "For distinguished personal service rendered American commerce and industry through raising the standards of advertising." The quotation is from the inscription on the award itself. Presentation of the medal was made on Feb. 17 at a dinner given in Mr. McGraw's honor at the Faculty Club, in Boston, under the auspices of the Graduate School of Business Administration of Harvard University. Mr. McGraw is the third to be thus honored by Harvard for noteworthy and conspicuous services to American industry, business, and trade. Professor O. M. W. Sprague, acting dean of the Graduate School of Business Administration of Harvard University, who presented the award, indicated the reasons for the bestowal of the gold medal upon Mr. McGraw in the following statement:

"JAMES H. McGRAW, president of the McGraw-Hill Publishing Company, was awarded the gold medal for distinguished contemporary service to advertising because of his lifelong service in the upbuilding of higher standards in advertising in the business press of the country."

Mr. McGraw, as president of the McGraw-Hill Publishing Company, is responsible for directing the destinies of the largest business publishing organization in the world. It has grown from one paper, purchased by Mr. McGraw in 1888, until today fourteen engineering and industrial magazines are published by the McGraw-Hill organization: twelve in New York, one in San Francisco, and one in London. Mr. McGraw is chairman of the McGraw-Shaw Company, publishers of industrial magazines in Chicago, and also chairman of the McGraw-Hill Book Company, one of the leading publishers of technical and business books. The weekly and monthly journals over which Mr. McGraw exercises executive control penetrate the industrial life of every civilized country. They cover the fields of non-ferrous metal mining; civil engineering and heavy engineering construction; the electrical, radio, electric railway, and motor-bus industries; the machine-using industries; the industries devoted to the generation and application of power; the chemical industries; and those concerned with coal mining. McGraw-Shaw publications serve industrial management and plant engineering through the broad sweep of industry as a whole.

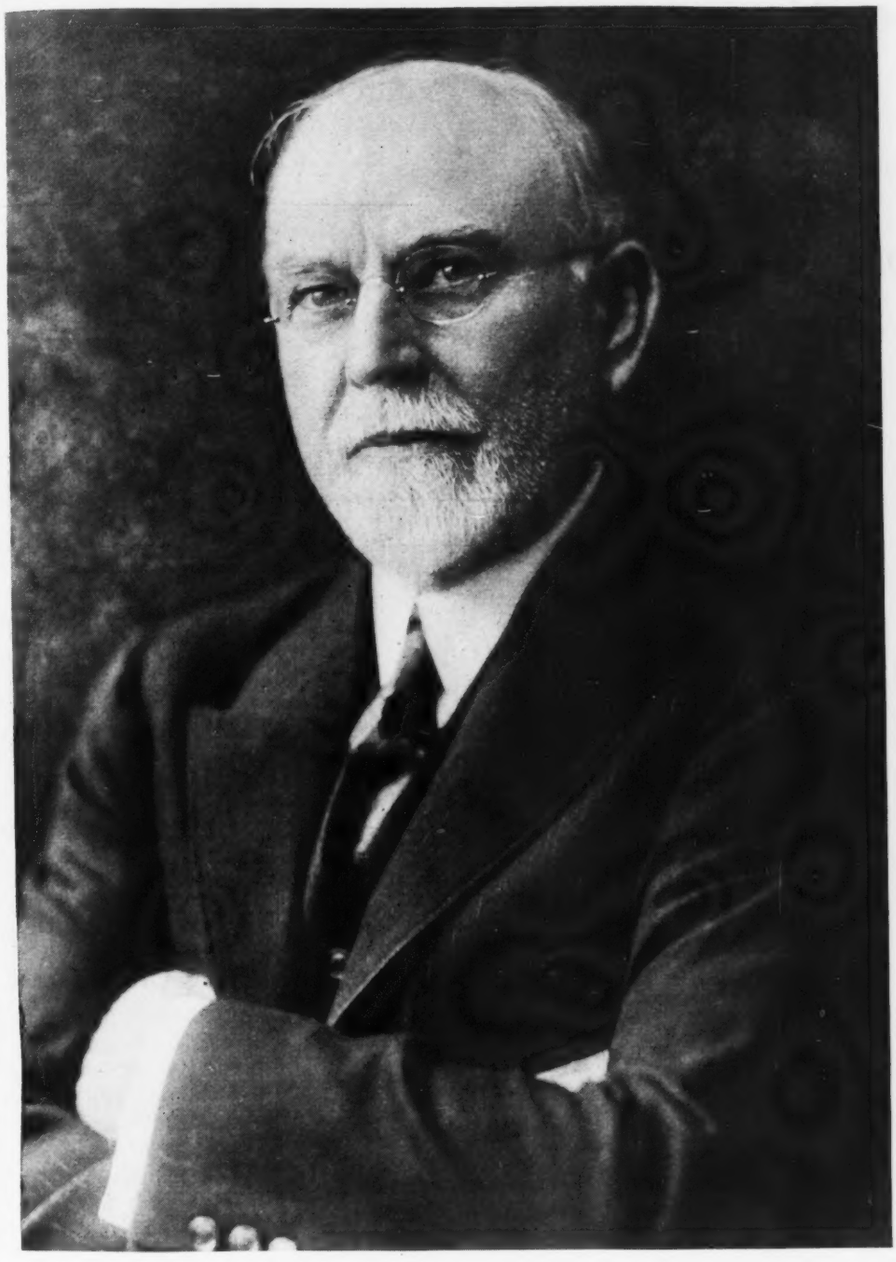
IN THE electrical and electric railway industries, Mr. McGraw has pioneered in development from the early days when electrical manufacturing consisted of an unrelated and scattered group of small shops and manufacturers. His publications have been responsible in large measure for the adoption of co-operative movements in many industries. They have insisted upon the elimination of unethical practices and unsound methods, wasteful and not in the public interest. Industry is today served by more than one hundred full-time McGraw-Hill editors.

Mr. McGraw, by reason of many years' familiarity with and study of the fields covered by the weekly and monthly journals published by the McGraw-Hill company and the McGraw-Shaw company, has acquired a knowledge unique among American executives with regard to world industrial and trade conditions. The award attests the value of his contributions to industrial progress—to the development of industry on an ethical basis—as appraised by one of America's great universities. In the field of business publishing Mr. McGraw has been a leader in securing adoption of the code of ethics and business practice which today governs the editorial, advertising, and business activities of the organized business press.

Mr. McGraw was unable to be present at the presentation of the Harvard award because of illness. Mr. Malcolm Muir, vice-president of McGraw-Hill Publishing Company, accepted the gold medal in behalf of Mr. McGraw and presented his address, which follows in part:

"WHEN, four years ago, these awards were announced, it was particularly gratifying to me that Mr. Bok, an outstanding editor and exponent of the highest publishing standards, should have so clearly sensed the social responsibility involved in the creation and use and sale of advertising. It is therefore with a full appreciation of its significance that I accept this medal. The honor has affected me deeply, and is one in which not only I but my family and my associates in business will take a justifiable pride. In behalf of all these I thank you with all my heart.

"With particular reference to the current situation, it is to be noted that the volume of trade is large. But competition is throttling; and profits, in some quarters, are declining. Some industries are despairing of customers. Has advertising, now so generally used, proven ineffective in maintaining full prosperity? Lower profits and idle capacity are not the concern of the stockholder alone. The public as a whole—employing and employed, as well as the investor—suffers a setback when profits are squeezed and wares go a-begging. Now, advertising has won its spurs in the economical movement of distinctive goods, with resultant public gain. Is it not the greater field of staples or near staples to which advertising must now be more widely applied, in both industrial and consumer fields? And may not we here find a tonic for the price competition malady, thus aiding to



JAMES H. McGRAW

restore complete industrial health? The slogan 'quality is remembered long after price is forgotten,' already accepted as a principle by industrial consumers, suggests distinct social advantages to consumers at large. Through the adoption of production economies, principally the greater use of power and the fruits of research, established industries constantly reduce the numbers of employees per unit of product. The surplus workers thus thrown off by older industries must be absorbed into new ones; otherwise, we shall have widespread unemployment, low standards of living, suffering, and discontent.

"Advertising's place in the development of new products is clear. New enterprises absorb surplus labor, create new purchasing power, stimulate consumer ambitions, render business profitable, and make for social well-being. Advertising is the loud speaker for development. In thus adapting it to its destined sphere of usefulness, we of the business press have endeavored to do our share. The very essence of the business press is an intimate relationship with and understanding of the industry or trade served. The significance of its editorial counsel finds reflection in the use of its advertising pages. Over inter-industry transactions the industrial paper throws an effective net, tapping in for every industry on its supply channels and affording the supplier a direct contact with his market. Through reading and advertising pages, it conduces to the lowering of producers' costs on consumers' products. Thus it tends to widen the profit margin. It transmits evidences of sustained demand, introduces new products quickly, demonstrates the power of quality. Through the trade paper is established a community of interest, embracing manufacturer, distributor, and dealer. We can look with great hope on advertising's promise for the maintenance of prosperity. It has an important rôle in widening the profit margin both in industrial and consumer transactions. It removes products from unhealthy price competition and reduces production costs by insistence on conformity of goods to needs and on standardization and simplification. It reduces distribution costs by challenging unsound marketing problems, and it is now entering an even larger arena where staples are battling before a price-obsessed public. It offers new weapons of quality and service in the struggle of business with meager profits. It assures, by price stabilization, continued improvement of product and the development of new products to minister to consumers' needs. For myself and my colleagues I pledge you my best endeavors in a continuance of study, research, and experiment, to correct misapplication of advertising, to make it a still more effective tool of business, and a still more beneficent agent in advancing the public welfare."

MR. McGRAW was born in Panama, Chautauqua County, N. Y., on Dec. 17, 1860. He came into the publishing industry from the principalship of an up-state New York school. He is a member of many engineering, business, and scientific organizations and of the Harvard Business Historical Society.

Nevada Consolidated Adopts Underground Mining

Removal of overburden became so expensive that the so-called Wedge shaft has been sunk on one of the old benches of the Ruth pit. This five-compartment concrete-lined shaft is over 700 ft. deep; it is seen at a distance in the upper photograph, and in greater detail at the left. Within two years or so, all mining will be done through this shaft, using a caving and slicing system

Thermic Reduction with Metals of

Bolivian Tin Concentrates

Fifth of a Series of Six Articles Based on Physico-chemical Studies in the Metallurgy of Tin

By C. G. FINK and C. L. MANTELL

Respectively, head, Division of Electro-Chemistry, Columbia University; and consulting chemical engineer, Pratt Institute, Brooklyn

RESEARCH next centered on the thermic reduction of tin ores with aluminum. It was desired to study, as a possibility of winning tin from its ores, the reaction represented by the equation:

$$3\ SnO_2 + 4Al = 3\ Sn + 2\ Al_2O_3$$

Calculated from the reaction, the proportions are 453 parts stannic oxide to 108 parts of aluminum, which gives 357 parts of tin. This is approximately 3¼ lb. of tin per pound of aluminum. With a tin ore of 60 per cent tin content, on the basis of the tin alone, about one part of aluminum would be required for five parts of ore. Because of the iron and other metals present which are aluminothermically reduced, and to allow excess aluminum for the reaction, a proportion of four parts of ore to one of aluminum was used.

One kilo of tin concentrate which had been ground in a ball mill was mixed with 250 grams of granulated aluminum and thoroughly stirred. The material was placed in a clay Hessian crucible. This particular batch could not be started with a magnesium ribbon or powder, and as a result was started by the use of an oxyacetylene torch. The reaction was as violent as the aluminothermic reduction of iron.

After the reaction had stopped, the charge in the crucible was cooled under water to see whether any tin was produced. The reaction was successful, but the method of cooling did not allow separation of the tin metal and the aluminum slag. Some hardhead was produced and also some material which metallographically resembled the aluminum tin alloys.

This experiment was repeated without change of detail. The reaction was started with the oxyacetylene torch. Clay crucibles were used in this work in preference to those of graphite, in order to avoid any possible carbon reduction of the tin ore. The crucible was covered while the reaction proceeded. After the reaction had stopped, the container and its contents were allowed to stand and cool very slowly over a period of sixteen to eighteen hours.

TIN SEPARATES READILY

There is a decided difference in the specific gravities of molten alumina and liquid tin. There is also a decided difference in specific gravity between the gangue of the tin ore and the liquid tin. The specific gravity of the gangue is very much closer to that of alumina than to the liquid tin. As a result, on cooling, a very good separation was made of the combined alumina and gangue from the heavier liquid tin. A sharp line of demarcation defined the solidified slag and the tin metal. Examination of the slag, after crushing, showed that it was almost entirely free of tin prills.

The tin metal was clean. It liquated easily. In liquation there was considerable amount of dross which could be shown to be caused by an excess of aluminum metal used in the reduction. The tin metal from the first batch was added to the metal from the second batch, and the liquated metal weighed 875 grams. This was the yield from 2 kg. of ore; and it was considered a good result considering how poor the first run was and that no attempt was made to obtain a good separation of metal and slag.

Further runs were made and yielded successively 60, 80, 92, and 96 per cent of the tin in the ore, the yield being taken as the weight of the liquated tin divided by the tin known to be in the ore as shown by the analysis. All this work was done on unroasted Bolivian concentrate.

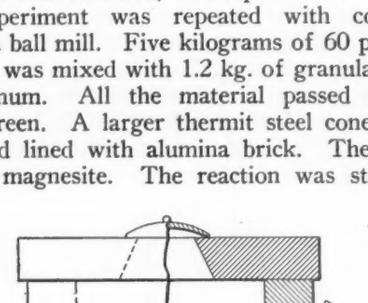
An attempt was made using a large charge of 5 kg. of ore with granulated aluminum in the proportion of about 4¼ parts of ore to 1 part of aluminum. Previous work had shown that it was difficult to control the reaction when the ore was not finely ground, or when it was used in the form in which concentrate was delivered. As concentrate the particles vary from those which will pass through a ½-in. and be retained on a ⅜-in. ring, all the way down to some material which will pass a 100-mesh screen. The 100-mesh material, however, is a small percentage.

Using this concentrate without grinding and attempting to reduce the ore with aluminum always resulted in a spluttering reaction which scattered the finely divided tin particles and did not allow collecting them in a button in the bottom of the crucible.

The charge of 5 kg. of ore plus the proportionate amount of granulated aluminum was ground in a ball mill until all the material passed a 24-mesh screen. The charge was then loaded into a thermic-reduction cone made of steel plate, lined with a magnesite refractory and equipped with a hood of steel plate. As a cover over the top part of the conical hood, a piece of 24-gage sheet iron was placed. After the reaction was finished this was riddled with holes and looked like a piece of screen or perforated sheet. The charge was too large to be easily controlled in the apparatus used. It proceeded so violently that a large share of the tin produced

was lost. As a result, instead of obtaining approximately 3,000 grams of liquated tin metal from the charge, only 2,200 grams was obtained, or 73 per cent.

This experiment was repeated with concentrates ground in a ball mill. Five kilograms of 60 per cent tin concentrate was mixed with 1.2 kg. of granulated 98 per cent aluminum. All the material passed through a 24-mesh screen. A larger thermit steel cone was used with a hood lined with alumina brick. The cone was lined with magnesite. The reaction was started with



Arrangement of furnace used for determination of melting points

ignition powder and magnesium ribbon. This reaction was quite violent, but could be controlled readily if due precautions were taken. After the mass had quieted down, the liquid slag and tin metal were allowed to separate, cool, and solidify. All the materials were then removed from the thermit cone. The lower layer of tin metal separated readily from the slag. The crushed slag showed no tin prills or metal fog. Chemical analysis showed it to contain some tin as silicate. The tin metal liquated readily. The yield of liquated metal was 2,900 grams, or 96.5 per cent of the metal in the original ore.

Ample evidence was deduced to indicate that with further study and development, the tin yield from the ore could be made almost quantitative. The process would have the advantage of producing clean metal, easily liquated, with little other slag save that of the aluminum oxide. The thermodynamics of the reaction are calculated below

$$Sn + O_2 = SnO_2 + 141{,}300 \text{ calories}$$
$$2\,Fe + \tfrac{3}{2}O_2 = Fe_2O_3 + 195{,}600 \text{ calories}$$
$$3\,SnO_2 + 4\,Al = 3\,Sn + 2\,Al_2O_3 + 361{,}300 \text{ calories}$$
$$2\,Fe_2O_3 + 4\,Al = 4\,Fe + 2\,Al_2O_3 + 394{,}000 \text{ calories}$$

This shows the reaction to be of the same order of magnitude as the iron reaction, the so-called Goldschmidt thermit reaction.

It is interesting to note in that connection that aluminum and iron are stated by Gwyer [1] to be completely miscible in the liquid phase. On cooling, mixed crystals are formed having the composition of 40 to 48 per cent iron and 66 to 100 per cent iron with an iron-aluminum compound formed which has a melting point of 1,145 deg. C. If this compound is more readily or more easily formed than the iron-tin alloys or hardhead compounds, the aluminum will thus act as a scavenger for iron in the tin metal, producing a tin more free from iron than that produced by any method in which aluminum metal is not used.

The economics of aluminum reduction of tin are not encouraging. Approximately three pounds of tin may be produced per pound of aluminum. At a current price in the United States of 25c. per pound of virgin aluminum, the cost per pound of smelting tin with aluminum would be 8⅓c. With scrap sheet aluminum at 14 to 16c. per pound this means an expenditure of 5c. per pound of tin. This is equivalent to a cost of $66 per long ton of 60 per cent tin concentrate, as compared with $50 by the commercial carbon eduction method.

A substitution of zinc for aluminum, on the approximate basis of a pound of tin per pound of zinc, with scrap zinc at 4c. per pound, gives an estimated expenditure of $52.80 per ton of 60 per cent concentrate.

Metallic reduction of tin concentrate may be of use in localities where tin deposits are too small to warrant a smelter or a reduction furnace. Reduction by aluminum or zinc requires practically no equipment. The method may be applicable in some locations. As a general smelting method, it does not show promise at present prices for aluminum.

Reduction of Stannic Oxide by Other Metals

It was desired to determine whether metallic iron at temperatures below its melting point would reduce stannic oxide in the solid phase at the maximum temperatures obtainable in small tube furnaces heated by chromel resistors.

A mixture by weight of 50 per cent stannic oxide and 50 per cent finely powdered metallic iron (hydrogen-reduced) was made. The stannic oxide was of the precipitated, c.p. grade. It was ignited to 900 deg. C. for one hour, cooled to room temperature, and ground in a ball mill for several hours to a very fine powder. The materials were thoroughly mixed by grinding together in an agate mortar.

Charges of approximately 5 grams each were placed in small alundum combustion boats. The boats were placed in electric-resistance tube furnaces. Temperatures were measured by a calibrated pyrometer. Nitrogen gas was caused to flow through the vitreosil furnace tube. The nitrogen gas was purified of oxygen by passage over heated copper gauze at 250 to 350 deg. C.; and of water vapor and carbon dioxide, by passage through calcium chloride and soda-lime towers in series.

On the first run, the charge was heated up to 810 deg. C. in about an hour, maintained there for fifteen minutes and allowed to cool in the nitrogen atmosphere to 50 deg. C. The boat was removed from the furnace and the charge examined both microscopically and chemically. As hydrogen-reduced iron is pyrophoric even as low as 40 deg. C., some iron oxide was produced. The presence of tin metal was made the criterion of the reduction of the stannic oxide by the iron. No metallic tin globules were observed under the microscope. Upon treatment of the sintered mass with boiling hydrochloric acid, testing the resulting filtrates for tin by hydrogen sulphide, no tin was found by chemical analysis. To avoid the possibility that some iron-tin alloys insoluble in hydrochloric might have been formed, with the resultant lack of appearance of tin during chemical analysis, the charges were also treated with a mixture of

[1] Z. Anorg. Chem. 57, p. 113-53.

hydrochloric and sulphuric acids, digested for one-half hour, and the resultant filtrate, after dilution with water, was tested for tin by hydrogen sulphide. No tin was found.

In a second run, the charge and boat were heated to 900 deg. C. in one and a half hours, and held at 900 deg. C. for fifteen minutes. Cooling in nitrogen as before took two hours to reach 20 deg. C., the room temperature. The heated charge had sintered as in the previous run. Chemical analysis of the material showed no tin; and no tin globules were observable under the microscope. Two additional runs, duplicating the conditions of the above, were made, with the same results of lack of reduction of the stannic oxide by the metallic iron.

It was not to be expected that there would be a reducing reaction between two solid phases, as in the case of the two powders, in an inert gas atmosphere. The experimental data show that solid finely divided iron is without reducing action on solid stannic oxide. It follows that it would not be expected that iron in the solid phase would exert any reducing effect on cassiterite. The sintering of the mass was due to small amounts of oxides of iron formed as the result of oxidation of the metal by the very small amount of oxygen present in the nitrogen and not entirely removed by the metallic copper gauze. Iron oxides were observed microscopically.

It is known that iron in the liquid phase has reducing action on molten stannic oxide with the formation of the iron-tin alloy, hardhead. This material, one of the banes of the tin smelters' existence, is readily formed above 1,132 deg. C., the melting point of stannic oxide.

Avoiding Formation of Hardhead

If temperatures of furnace operation are such that neither stannic oxide nor metallic iron is in the molten condition, the tendency to form hardhead should be lessened. It is well known that the rate of alloying between tin in the liquid phase and iron in the solid phase is slow in comparison with the reaction between the metals when both are in the liquid phase. Gaseous reduction (economical at 750 deg.) operates at temperatures well below the melting points of either stannic oxide or metallic iron. Hardhead troubles should, therefore, be considerably reduced in gaseous reduction. Experimental evidence shows this to be true.

It was further desired to determine whether molten bismuth had any reducing effect on stannic oxide. Bismuth compounds are usually constituents of Bolivian tin concentrates. Such compounds, and among these the oxides, are more readily reduced than is stannic oxide by reducing agents. Fifty grams of bismuth were melted in a nickel crucible and 10 grams of stannic oxide were stirred into the molten metal. The metal temperature was maintained at 300 deg. C. for one hour, the stannic oxide being continuously stirred in. At the end of that time, the mass was poured into water to granulate the metal. (Bismuth melts at 268 deg. C.) Samples of the granulated metal were analyzed for tin. No tin was found.

Similar determinations were made in the case of lead. Lead melts at 327 deg. C. The molten lead was maintained at 350 deg. C. for one hour, the stannic oxide being constantly stirred in. The metal was granulated as in the experiment with bismuth and tested for tin. No tin was found qualitatively with mercuric chloride.

Similar determinations in tests with molten copper at 1,075 deg. C. showed that copper is without reducing action on solid stannic oxide.

The thermophysics of these reactions are as follows

$Sn + O_2 = SnO_2 + 141{,}300$ calories
$Pb + O = PbO + 50{,}800$ calories
$Pb + O_2 = PbO_2 + 63{,}400$ calories
$2\,Bi + 3\,O = Bi_2O_3 + 139{,}200$ calories
$2\,Fe + 3\,O = Fe_2O_3 + 195{,}600$ calories
$Fe + O = FeO + 65{,}700$ calories
$Cu + O = CuO + 37{,}700$ calories
$SnO_2 + 2\,Fe = Sn + 2\,FeO - 900$ calories
$3\,SnO_2 + 4\,Fe = 3\,Sn + 2\,Fe_2O_3 - 32{,}700$ calories
$SnO_2 + 2\,Pb = Sn + 2\,PbO - 39{,}700$ calories
$SnO_2 + Pb = Sn + PbO_2 - 77{,}900$ calories
$3\,SnO_2 + 4\,Pb = 3\,Sn + 2\,Pb_2O_3 - 175{,}000$ calories
$3\,SnO_2 + 4\,Bi = 3\,Sn + 2\,Bi_2O_3 - 145{,}500$ calories

The conclusion, therefore, is drawn that molten iron, lead, bismuth, and copper are without marked reducing action on stannic oxide. In the reduction of a concentrate the oxides of these metals will consume the reductant. The reduced metals do not in turn reduce tin oxides with which they are in contact.

Effect of Iron and Bismuth Oxides on Melting Point of Stannic Oxide

Bolivian tin concentrates contain a large number and amount of impurities. Those which are most important are the compounds of iron and bismuth. Bolivian concentrates come from "vein" ores. Ordinarily concentrates of vein origin fuse at lower temperatures than those of alluvial origin, owing to the greater impurities of the original veins and the difficulty of dressing vein ores.

To determine the effect of iron and bismuth oxides on the melting point of stannic oxide, samples were made containing these materials in the proportions in which they occur in the concentrates.

Sample I was made by thoroughly mixing exactly 50 grams of calcined stannic oxide with exactly 3.0000 grams of carefully dried c.p. ferric oxide. Each of the materials was in the form of a fine powder, ball-mill ground. The particle size of maximum occurrence was 3 μ.

Sample II was made of exactly 100 grams of calcined stannic oxide ground in a ball mill and exactly 1.0000 gram of c.p. bismuth oxide. The bismuth oxide had previously been dried to constant weight.

The first sample calculated to 94.35 per cent SnO_2 and 5.65 per cent Fe_2O_3, the second to 99.01 per cent SnO_2 and 0.99 per cent Bi_2O_3.

Melting point determinations were made following the A.S.T.M.[2] procedure for determination of the fusibility of coal ash, using the furnace arrangement as recommended for this work. The furnace was operated with a minimum amount of excess air. The equipment is shown in the accompanying sketch.

Using as small an amount as possible of a 10 per cent dextrin solution as a binder, triangular pyramids about 20 mm. high and 6 mm. wide at the base were made from the powders. Cones were also made of pure ferric oxide and stannic oxide. They were placed vertically in a muffle or crucible as shown. The rate of heating before and during softening of the pyramid was from 5 to 10 deg. C. per minute. During the operation the pyramids were supported in a plate pot of alundum cement. The crucible was of hard-burned fireclay. After moulding, the pyramids were mounted as soon as dry in the refractory base. They were then ignited at a dull red heat for thirty minutes in the open muffle, to remove the carbonaceous binder.

Heating was controlled so as to be gradual up to 800

[2] A.S.T.M. Standards 1924, p. 994, also Fieldner, Hall and Field, Bureau of Mines Bulletin No. 129.

deg. C., after which the temperature rise was maintained at 5 to 10 deg. C. per minute.

Softening temperature is defined as the point at which the pyramid or cone fuses down to a lump or ball. Initial deformation temperature is given as the first rounding or bending of the cone. The fluid temperature is that temperature at which the cone spreads out over the base in a flat layer.

Temperatures were measured with a disappearing filament-type Leeds and Northrup optical pyrometer. The data for the samples are given below:

Material	Softening Temperature	Initial Deformation Temperature	Fluid Temperature or Melting Point
Fe_2O_3	1,492	1,497	1,503
SnO_2	1,120	1,125	1,130
Sample I	918	925	932
Sample II	841	854	863

It is illuminating to see how greatly the small amount of bismuth oxide affects the melting point of stannic oxide. As ferric oxide has a higher melting point than bismuth oxide, the effect, though large, is less marked.

These determinations give some insight into the effect that the oxides of iron and bismuth have on the fusion point of tin concentrates. In gaseous reduction, the operation depends upon the absence of slagging until complete reduction is effected. In can be seen that with ores high in bismuth oxide, means may have to be employed to counteract the lowering of the melting point of the concentrates. Our experimental work has shown us that small amounts of lime up to 1 per cent by weight of the charge are very effective in raising the melting point to prevent undesired slagging of the material.

Oxide-Sulphide Copper Leaching

RESEARCH on the iron oxide oxidation step in the process developed by the U. S. Bureau of Mines to make mixed solutions of ferric sulphate and sulphuric acid, suitable for leaching certain types of low-grade oxide-sulphide ores, is described in Serial No. 2839, by F. E. Wartman and H. E. Keyes. The conclusions reached are as follows:

1. For each particular set of conditions in aëration there is a size of bubble which will give the most efficient result. Small bubbles are in general most desirable.

2. Within the limits 10 to 80 deg. C., the higher the temperature, the more rapidly may the iron be oxidized.

3. For efficient operation in pure solutions at a temperature of 40 deg. C., there should be at least three times as much oxygen as sulphur dioxide in the ingoing gas. The initial solution if completely reduced should not contain over 10 grams per liter of sulphuric acid.

4. No apparent relation exists between the value of static surface tension of the solution and the degree of bubble coalescence.

5. Coalescence of bubbles during the aëration process may be controlled by mechanical or physical means. Mechanical means include the even sizing of bubbles and the proper apportioning of the liquid to gas in the aëration "emulsion." Physical means include the solution or suspension of certain materials in the gas or liquid phase of the aëration emulsion.

6. The oxygen absorption coefficient of the solution may be used as an index of the ease with which the solution may be treated by the ferric sulphate process. The maximum capacity for converting sulphur is found when the solution has an iron concentration of about 5 grams per liter.

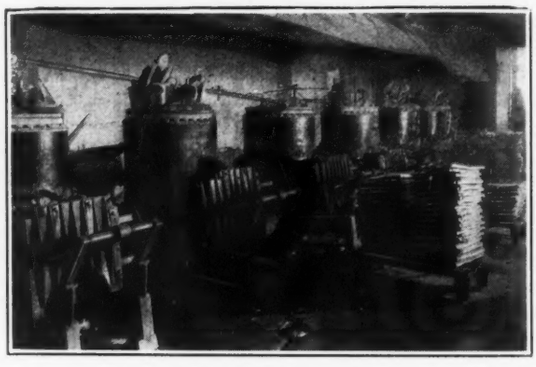
Making Tin Foil Today

MANUFACTURE of tin foil is one of the most remarkable arts of large-scale production today. Although foil is produced in several countries and by competitive concerns in America, the detail of operation differs sufficiently in various plants to make it a matter of specialization in mechanics and machinery, according to Joseph W. Piatt, in *Industrial Gas* for December, 1927.

Tin foil was first made in China centuries before it was known to Europe, states Mr. Piatt. So far as can be learned, bars of metal were first hammered into sheets and, when too thin for further manipulation under the direct stroke of a hammer, were put between sheets of leather and hammered into thinner sheets. The process was repeated until the bright foil was thinner than any paper conceivable, being similar to gold leaf, a gold foil still made by the same primitive process. Lead foil also was without doubt a Chinese product originally.

Today, automatic machinery is used for foil making. The foil must meet exacting conditions. Excellent handmade book paper will run about 200 sheets to the inch of thickness. Tin foil for use in radio condensers will run 4,350 sheets to the inch and is permitted to vary from that thickness by only one forty-five-millionth of an inch. To make scientifically sure that the exact thickness of tin foil is produced, a sample section of it is weighed and its area compared to the area which a pound of the metal should produce. The lightest foil made in a certain plant, for instance, is 14,500 sq.in. to the pound of metal, or, roughly, 100 sq.ft. of tin foil.

Tin foil is necessarily made in various thicknesses which are carefully studied so that the proper metal may be prepared to give the correct flexibility, durability, and strain-resisting qualities desired. Uses of foil are



A battery of six gas-fired melting pots at the plant of a tin-foil manufacturing company. Tin is melted in these pots and cast into plates for rolling into tin foil.

numerous and new ones are constantly being developed. In mechanical applications tin foil is used because nothing else will do. It is used for electrical purposes, such as burglar alarms, foil plates for packing between condenser dielectrics, especially in radio, which is a very large item in consumption, and in electrotyping as solder.

Incidentally, the tin-foil plant referred to above melts and prepares its alloys with the aid of gas heat. This plant has found better equipment as the years have passed and has increased the fuel demand. It still uses gas, nevertheless. Ten melting pots are used with high-pressure gas, and three pourings of metal per day are utilized in producing the metal plates sent through the rolls in the first stage of manufacturing the foil.

What Does Western Tasmania Hold for the Prospector?

By Percy O. Lennon
Royal Colonial Institute, London

THE FIRST important mineral discovery in Tasmania was made 40 years ago by a prospector at North Heemskirk. At about the same time tin was discovered at Bischoff by "Philosopher" Smith. From then on the mining industry became firmly established in the state. Considering that the total area of Tasmania is only about 26,000 square miles, the mineral recoveries made during the last half century may be regarded as remarkable, and all the more so because the greater part of the mineralized country lying in the western area of the island is still undeveloped, and is explored only sufficiently to give a rough idea of its hidden wealth. This is because of the rugged nature of the country and the dense forests, which prevent successful exploration beyond a radius of a few miles from the base of operations.

Since the discovery of osmiridium in the Adams River

A prospector washing a pan of gravel, along the Adams River

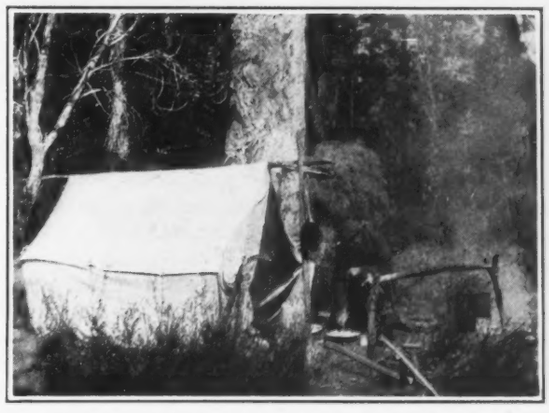
district in 1925, much prospecting work has been done in the western and southwestern areas. A few tracks, some of them over half a century old, have been cut through in different directions, but with one or two exceptions they have not been of a permanent nature. Most of these have become overgrown with scrub and littered with fallen timber. In many places it has become exceedingly difficult to distinguish them from the surrounding bush. The prospector, therefore, frequently finds it easier to hew his own route with axe and slash-hook, instead of wasting time seeking out the original track. Prospecting in these western waste lands is more difficult than in any other part of Australia. Owing to the roughness of the country everything has to be hand-packed, for it is impossible to take horses. The average prospector "humps a swag" of between 70 and 100 lb. in weight, and, needless to say, carries only necessaries. The food supply generally consists of bacon, flour, oatmeal, and tea. A blanket for each man, a small tent and fly, slash-hooks, axes, picks, shovels, prospecting dishes, a frying pan and "billies" make up the rest of the equipment. On a long trip each prospector usually takes two packs, carrying one ahead for so many miles each day, and then returning and fetching the other. Under such conditions as these traveling is painfully slow. In scrubby areas a pathway has to be cut to permit the prospector's passage forward. Prolonged halts have to be made to fell trees to bridge the deeper rivers. Steep ranges have to be crossed, and dangerous gullies and swamps also. The awful horizontal scrub peculiar to this part of Tasmania grows in beds often many acres in extent, and generally has to be crossed monkey-fashion, perhaps twelve or fifteen feet above the ground.

On the Gordon River, Western Tasmania. Note the dense and almost impassable brush

In such country a mile a day is the average distance covered. In heavily timbered country traveling is also difficult, for the rotting trunks of fallen trees lie everywhere, and it is no easy matter to scale these, because of their enormous girth.

On long expeditions prospectors supplement their supplies by snaring game, and wallaby, kangaroo, wombat, and even the humble porcupine frequently figure in the camp "billy." Striped marsupial wolves are still to be found in these rugged western mountains, although now extinct in the settled areas of the island. Locally known as the "tiger" or "hyena," they are regarded with superstitious dread by many prospectors and hunters. Tasmanian devils and marsupial tiger cats are plentiful in the west, the latter creatures being very mischievous, raiding prospectors' camps for stores whenever opportunity offers.

The rivers in these districts seem almost devoid of fish, other than eels and huge, green fresh-water lobsters.



A prospector's camp in the Tasmanian wilds

Down in the forests, these rivers are most uncanny places, banked as they are with a profusion of luxuriant vegetation, which constantly interlocks overhead and forms great leafy tunnels through which the rays of the sun seldom penetrate. In the summer twilight numerous

duckbilled platypus may often be seen disporting themselves round the half-submerged logs that litter these watercourses. A link between mammals and the lower forms of life, these paradoxical little creatures are living relics of far-off Mesozoic times.

Quite apart from the investigation of its mineral deposits, the geologist finds western Tasmania a place of

A 2,500-ft. gorge on the Gordon River, Western Tasmania. It is over such obstacles as these that the prospector has to fight his way

most absorbing interest. The only inhabitants of this inhospitable wilderness are anachronisms — strange marsupial carnivora and other beasts which one and all belong to a day when the old world was young. In other lands they find the fossilized remains of these creatures deep down among the rocks—but here they still persist in a living form.

Development in the "Lost Province" Has Been Slow

Owing to the tremendous difficulties and hardships that have been attendant upon prospecting and exploration work in the "lost province," as this section of the island has been called by Tasmanians, development has of necessity been slow, especially since in the past it depended entirely upon individual effort. Traveling is so slow and arduous that by the time the area to be prospected has been reached, the stores have often been nearly exhausted, and the prospector has not sufficient time for a satisfactory investigation of the country. The difficulty in obtaining provisions in these wilds presents an almost insuperable obstacle to the solitary prospector. There is a constant danger of starvation, for, without lines of communication or means of transport, flooding of one of the many treacherous rivers cuts him off from civilization.

Since 1880 the production of minerals in Tasmania has been no less than £51,365,492. Tin, worth £15,000,000, has been obtained almost half from the west coast. The copper mines have produced £17,719,000, of which the famous Mount Lyell property contributed over 90 per cent. Silver and lead, largely from the west coast, have been mined to the extent of £7,824,000. Zinc production amounted to £369,000. In addition, iron ore, osmiridium (worth about £300,000), bismuth, iron pyrites, gold, and cadmium have been produced to the value of many thousands of pounds. Gem stones are also obtained in some of the granitic deposits. Coal of good quality occurs in Permo-Carboniferous formations; moreover, shale oil and cement are found in many localities.

The federal government recently sanctioned a large annual grant for opening and developing the western districts. Generous sustenance allowances are now granted to prospectors operating in approved localities, and a Great Western trunk railroad is already in the course of construction. This will throw open much of the now almost-unexplored country. A geophysical prospecting survey has been instituted by the Director of Mines, A. McIntosh Reid, and with its aid it is not unlikely that many mineral deposits which have hitherto eluded vigilant but poorly equipped prospectors will be located.

Almaden Mercury Output Sold

APROPOS of the recent award for the 1927-28 production of mercury from the mines of Almaden, in Spain, the administrative council of the mines has released complete information relative to the output of recent years, according to *Commerce Reports*. The tender of bids for the 1927-28 production was made in September and elicited more than usual interest. The Sociedad Española del Mercurio, Italiano Monte Amiata, Lazard Bros., Santa Barbara de Bilbao, and Antonio Lopez Roberts each bid £15 to £17 per flask of 75 lb. The highest bid was that of Lazard Bros., £17, who received the award in principle. The Sociedad Española del Mercurio, however, enjoying its contract rights, exercised the right of revision and received the definite award at £17 per flask

According to the *Estadistica Minera,* the holdings at Almaden occupy an area of 196,349 hectares. The number of laborers employed in 1926 was but approximately 80 per cent of the average for the ten years; though the production of ore nearly doubled and the value of refinery production increased more than 50 per cent.

The accompanying table showing the relation of power required to output contains the principal data as to the metallurgical activities of the industry.

Relation of Power Required to Output of Almaden Mercury Industry

	Power Required				Output			
Year	Number of Laborers	Number of Retorts	Steam Hp.	Electric Hp.	Ores Treated Metric Tons	Mercury Obtained, Kilos	Average Purity, Per Cent	Estimated Value, Pesetas
1917.....	395	28	20	..	11,944	827,115	6.925	9,228,130
1918.....	362	26	20	..	8,255	544,654	6.622	6,076,524
1919.....	318	24	20	..	19,927	1,207,631	6.06	19,261,714
1920.....	372	24	20	..	20,687	484,840	6.06	11,756,434
1921.....	365	13	20	..	10,337	619,004	....	5,471,995
1922.....	412	13	20	..	25,006	1,314,160	....	11,817,535
1923.....	363	24	..	5	22,133	1,136,071	8.00	10,735,871
1924.....	395	24	..	5	18,340	893,663	7.00	8,445,105
1925.....	440	26	..	5	20,884	1,270,541	7.66	14,359,410
1926.....	366	23	..	5	30,354	1,588,821	5.23	17,397,590
10-year average	378	..	..	..	18,786	988,650	....	11,455,030

Crushing Rolls for Ore and Rock—

Their Development

CONCLUDING INSTALLMENT

By W. T. W. MILLER

Engineer in Charge, Crushing Machinery Department, Hadfield's Limited, Sheffield, England

THE MACHINE shown in Fig. 10 had swinging pillow blocks for the adjustable roll, and double tiebolts were fitted above and below the bearings with the springs disposed in the direct line of thrust. The movable roll was held at the desired distance from the fixed roll by means of removable packings and spacer blocks between the bearings. This machine was made by the Gates Iron Works and was known as the "Economic" rolls. Rolls of the swinging pillow block type were rarely made in sizes exceeding 36 in. diameter and were not suited for continuous heavy work.

When crushing rolls are fitted with springs to relieve overstrain, the passage of any material of unusual hardness near the edge of the rolls causes the movable shaft to swing out of parallel with the main shaft and seriously disturbs the alignment of the bearings, creating one-sided strains which are dangerous to the machine. As the journal sizes were increased this tendency became more pronounced, and swivelling bearings were introduced to allow freedom for irregular movement.

The Gates "High-Grade" rolls, shown in Fig. 11, occupied a pre-eminent position in the mining machinery world for many years. At the time of their introduction they represented a considerable advance over the machines in general use, and it is probable that they were the first roll crushers to be fitted with self-aligning bearings on both shafts. The journal boxes were each made in one piece without a loose cap. They were lined with babbitt metal and had large lubricating cavities packed with woolen waste. Owing to their shape they had to be threaded over the ends of the shafts and lifted into place in that position. The recesses for the bearings in the frame and in the sliding cradles were bored vertically, and the boxes were machined to correspond so that each journal was free to swivel sideways, and either shaft could right itself to any movement taking place in the horizontal plane.

Bedding surfaces for the sliding cradles were increased in area, and renewable wearing plates were fitted to the frame to combat the chattering effect which is so destructive in any crushing machine. Heavy tension rods, passing under the bearings, and through spring caps, frame, and sliding pedestals, were arranged to transfer the pressure of the springs to the movable roll and to maintain the proper distance between the rolls.

As originally designed the nests of springs on each side of the mill were secured by the main tension bolts, and when these were unscrewed to remove the shims or packings between the bearings, in order to adjust the rolls, the springs had to be released and compressed on each occasion. In later machines the pressure was retained by means of short independent tiebolts connecting the spring plates so that the tension rods could be released or removed without disturbing the springs.

Fig. 12 illustrates the old Fraser and Chalmers rolls. In this machine the bearings for the fixed-roll shaft were cast integral with the frame, fitted with removable caps, and lined with babbitt metal. The swiveling bearings for the movable roll were cradled in heavy brackets supported on long bearing slides forming part of the main frame.

The tension rods were forged with central collars so disposed that they served the double purpose of retaining the spring pressure and securing the shims. Since the tiebolts were screwed at either end, with the collars bearing against the inner buttresses supporting the fixed-roll bearings, the nuts at one end could be used to vary the compression of the springs and those at the other end to alter the roll setting.

Owing to the limited area of contact between the collar and the frame, and to the abrupt change in section of the bar, this form of construction was not well suited to withstand repeated shocks. This point will be referred to in more detail later.

THE SANNA-BERNARD ROLL

In the Sanna-Bernard rolls, of French origin, shown in outline in Fig. 13, the weight of the moving parts was utilized to increase the pressure between the roll faces, and both rolls were supported in a similar manner, so that each was equally free to move outward should displacement occur under overload. The rolls were suspended in radial arms pivoted near to the vertical axis of the machine and as close as possible to the upper surfaces of the rollers. Normally the arms were kept the required distance apart by means of adjustable stops resting in recesses in the central abutments on either side of the frame. Tierods with strong springs were used to connect each pair of swinging arms and add to the pressure between the rolls. Although theoretically good, the flexibility of the various connections and the instability of the structure rendered this design of little service for hard work.

Many engineers consider that springs are very undesirable adjuncts in any crushing machine and that, wherever possible, their use should be avoided. Unless the springs are sufficiently powerful to withstand the shocks, they cause "chattering," with heavy wear on the bearing

Copyright reserved by the author.

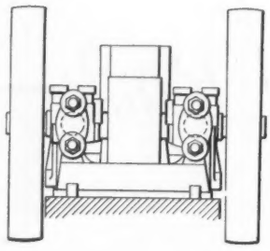
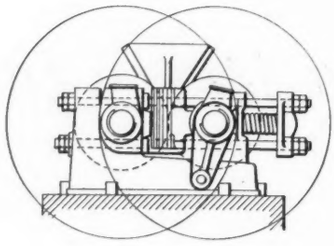
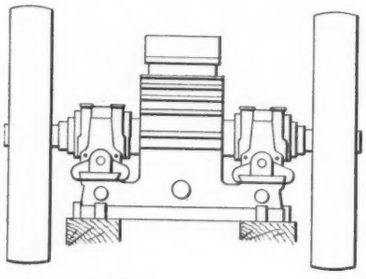


FIG. 10





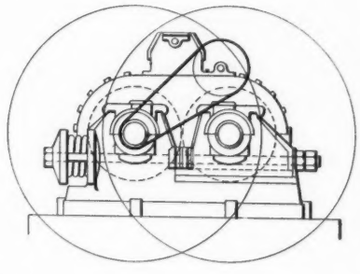


FIG. 11

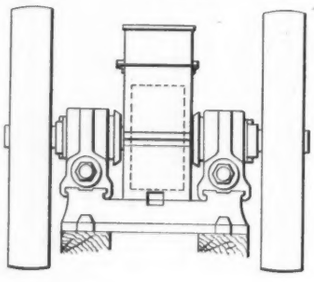
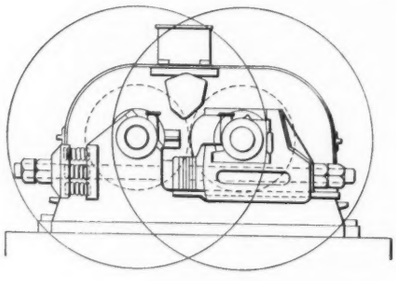
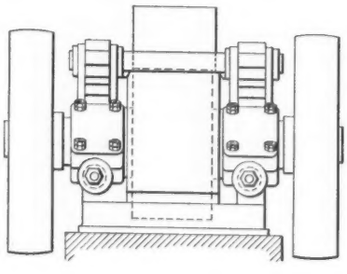


FIG. 12





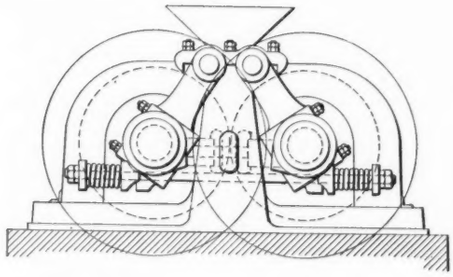
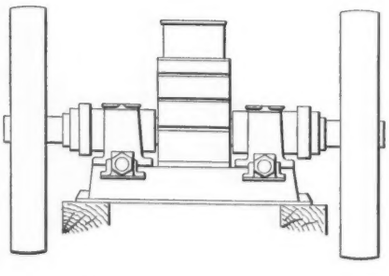


FIG. 13



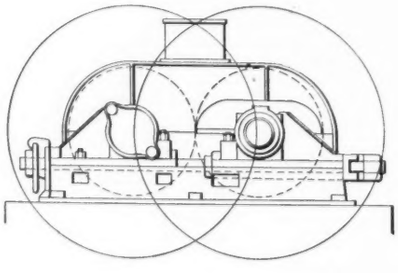
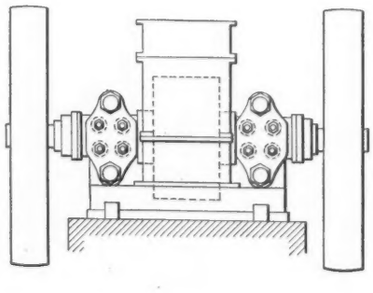


FIG. 14



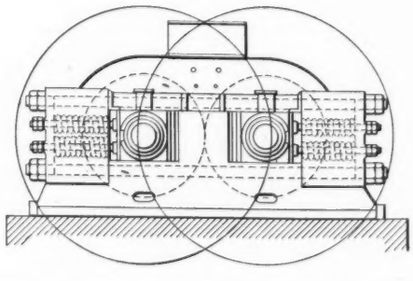


FIG. 15

Crusher Rolls Shown on Page 332

Fig. 10—In this set of crushing rolls swinging pillow blocks are provided for the adjustable roll
Fig. 11—The rolls shown here were probably the first to be fitted with self-aligning bearings on both shafts
Fig. 12—The type of construction in these rolls was not well suited to withstand repeated shocks
Fig. 13—In the Sanna-Bernard machine, the rolls were suspended in radial arms pivoted near the vertical axis
Fig. 14—Example of rigid rolls without springs
Fig. 15—A set of balanced rolls. Under shock the force of impact is lessened, relieving the frame and foundation

slides, and the opening and closing of the aperture degrades the product from the machine.

Rigid rolls without springs have been placed on the market by various firms, and Fig. 14 may be taken as typical of this class of construction. This design was prepared by the Denver Engineering Works a number of years ago. The frame was made of shallow box section, the bearings for the fixed roll were bolted down to the bedplate, and those for the adjustable roll were clamped to the frame slides and secured from end movement by tension rods, which passed below the pillow blocks taking the end thrust off the base plate.

Breaking blocks with shearing pins were inserted between the retaining nuts on the tension rods and the ends of the pedestals for the adjustable roll to act as a safety device and to prevent possible damage to the roll shafts or pulleys that might be caused by the presence of uncrushable material in the feed.

Rigid rolls, when used for moderately fine crushing, must be carefully fed, as they are much more likely to choke or "stall" than spring rolls. Irregular feeding and occasionally dampness in the ore cause packing, with intense rise of pressure between the roll faces, which in turn is transmitted to shafts and bearings. When springs are fitted these give way sufficiently to allow the packed material to pass, but the rigid rolls under similar conditions are brought to a sudden stop. For the same cause these rigid rolls are hard on the bearings, and are likely to run warm at speeds which are perfectly safe for spring rolls.

Balanced rolls manufactured by the Sturtevant Mill Company appear in Fig. 15. In the large sizes these rolls have double tiebolts on both sides, with spring batteries behind all four bearings. It is claimed that by this arrangement the displacement under shock moves each roll an equal distance, which is half that in the standard type of spring roll; the speed of movement is also halved and, since shock increases as the square of the velocity, the force of impact is reduced in proportion. On the return of the bearings to their normal position the forces balance and offset each other, so that the frame and foundation are relieved from shock to a considerable extent.

Since the upper tension rods are situated above the bearings, they have to be removed before the rolls can be lifted, and in this sense the design is not adaptable for ease in renewals. Nevertheless, this system of double tierods undoubtedly insures a more equal distribution of the tensional strains and gives a stronger construction than with a single tiebar on either side.

The Traylor Engineering & Manufacturing Company has standardized a series of crushing rolls embodying certain special features. Fig. 16 is typical of the arrangement of parts in these mills. It is usual for the bases of the movable bearings to project over and hook under the frame slides, but in these particular rolls the under surfaces of the moving pillow blocks slide in wide recesses in the frame so that the bedding faces are brought as close as possible to the journals. Both the ways in the frame and the grooves in the bearing bases are protected by hard steel wearing strips, which offer a means of renewal should wear take place.

Springs, arranged in two groups, rest in seatings in the end of the frame and are compressed by heavy spring caps, each battery being tightened by two strong bolts. The tension rods pass through the nests of springs and the spring caps and yokes form recesses in which lie two special worm-wheel nuts which are adjusted by means of a single worm shaft carried in bearings built on the caps. By turning the worm shaft the bearings are adjusted in unison, so that the correct alignment is maintained and the setting may be changed without disturbing the springs or using shims.

One roll is frequently fitted with an automatic side-adjustment or "fleeting" device to reduce the tendency for corrugations to form in the surfaces of the roll shells.

In Fig. 17 are shown the well-known Allis-Chalmers Style "B" rolls, which were based on the early Fraser and Chalmers design. During the long period in which they have been in service these machines have varied slightly in detail. In the construction illustrated, the tension rods are modified from the older form, the springs are also secured by independent bolts so that they are not affected by the setting of the rolls and the objectionable middle collar on the tierod is eliminated. Rolls of this type are usually fitted with a simple mechanism for the lateral adjustment of the fixed-roll shaft to insure the roll faces being in line, and to neutralize, as far as possible, the formation of flanges on the ends of the roll shells in the process of wear.

It is evident from the brief description of the machines so far discussed that the combination of split bearings with renewable caps and tension rods passing under the roll shafts presents decided advantages on the score of accessibility. Thus it is possible to lift rolls and shafts and, if need be, renew the bearings without disturbing tension rods, springs, or pillow blocks. It must be admitted, however, that this construction is not ideal for equal distribution of the strains caused by the passage of uncrushed material or excessive overload of any kind. The reactions are not in line with the point of application of the disturbing forces.

The Anaconda Rolls

The Anaconda rolls, Fig. 18, were originally made for the Washoe Works, at Anaconda, and were designed to bring the springs immediately behind the movable bearings in the direct center line between the rolls. Tierods and thrust screws were so disposed that the frame was relieved from tensional and side-racking strains while retaining the advantage of ready access to rolls and

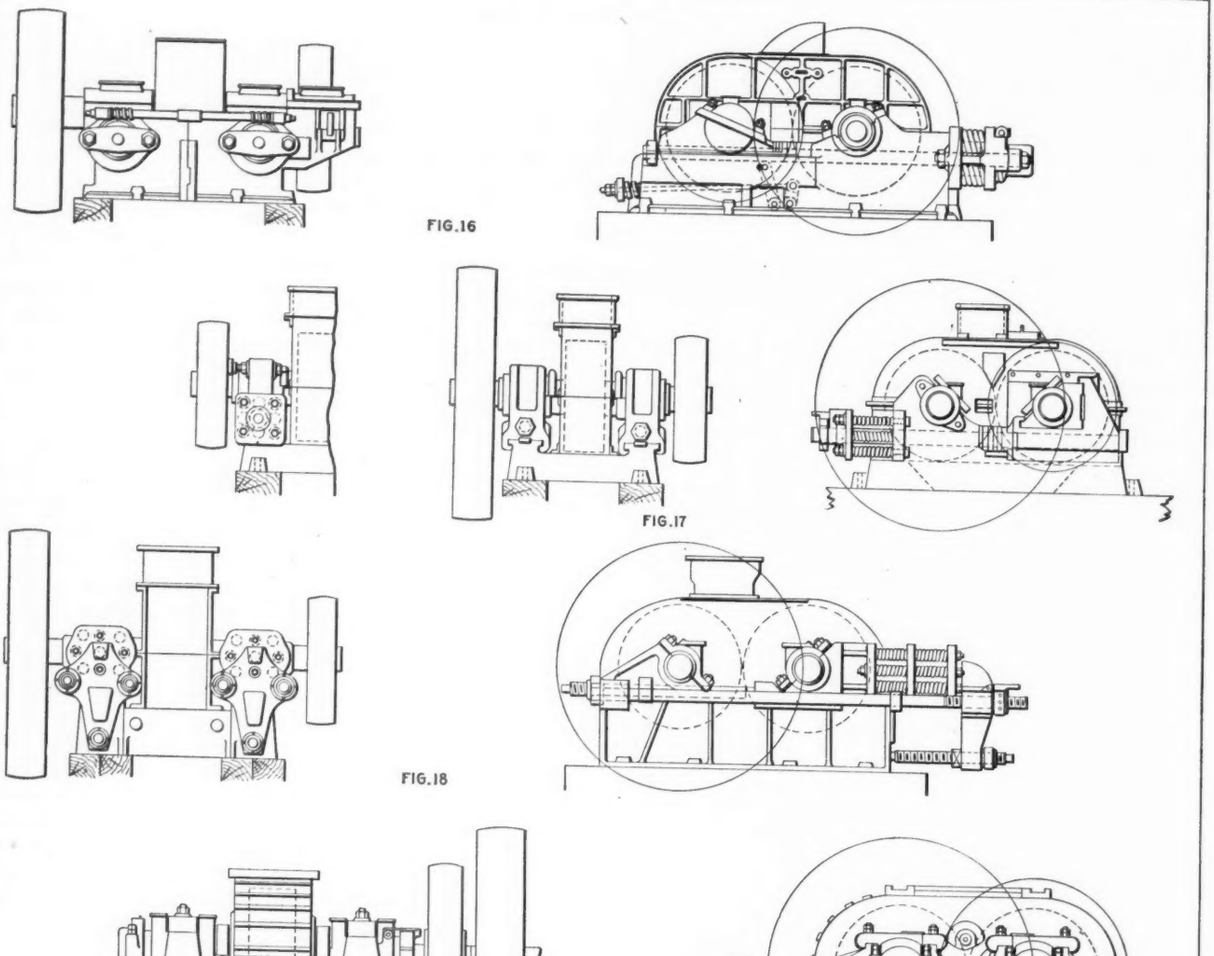


FIG.16

FIG.17

FIG.18

FIG.19

FIG.20

FIG.21

Crusher Rolls Shown on Page 334

Fig. 16—In this type of crushing rolls a worm shaft is provided, by turning which the bearings may be adjusted in unison and the correct alignment maintained

Fig. 17—Provision for lateral adjustment of the fixed roll shaft to insure proper alignment of the opposing faces is made in this machine

Fig. 18—A set of Anaconda rolls, which was designed to bring the springs immediately behind the movable bearings in direct center line between rolls

Fig. 19—Garfield-type rolls, which are among the most powerful machines for crushing on the roller principle

Fig. 20—A high spring pressure of 30,000 lb. per inch width of face makes these Buchanan rolls practically rigid for crushing the hardest ores

Fig. 21—The Ajo-type rolls, the largest and most powerful narrow-faced rolls built

bearings. These rolls were of considerable size, 40 to 54 in. diameter, and were intended for heavy duty, being fitted with exceptionally powerful spring batteries, as compared with those in general use at the time of their introduction. Each nest of springs was divided into two series by means of center and back spring plates, and the complete battery was tied to the rear end of the sliding pillow block by four or more long bolts.

Tension rods, two on either side of the machine, were situated underneath the bearings and below the springs, and the special feature of the mechanism was the means adopted for transmitting the load from the springs to the tierods. Two heavy cramps or vertical levers were used for this purpose, which engaged with boss projections on the back spring plates and fulcrumed on long adjusting screws. Except for their proportions, these cramps were generally similar to those used for holding the turning tool in the slide rest of a lathe or for clamping the work to the bed of a planing machine.

Bearings for the movable roll were adjusted laterally by two large stud screws which passed under the fixed-roll journals and pressed against the bases of the saddles for the swivel bearings. When the main tierods were tightened, the jaws of the cramps were forced against the spring caps, and the movable bearings, with their containing brackets, were held in contact with the screw stops. Although somewhat cumbersome, this arrangement of springs and tierods proved effective in service, the weak feature in the design being the stop screws for limiting the travel of the movable bearings. Not only were these susceptible to deformation under the chattering and hammering from overloaded springs, but these same destructive forces were transmitted in an awkward manner to the frame of the machine.

A series of machines were developed by the Allis-Chalmers Company, known as the company's "XX Straightline" roll. They followed the Anaconda principle except that single heavy tiebolts were used on either side of the machine instead of the double tension rods, and packing shims or spacer blocks between the bearings instead of the stop screws. In these later rolls the bearings were of the solid car-box type and were threaded over the shafts. The shims were placed on the direct center between the bearings, thereby emphasizing the straight-line feature from which the rolls derive their name.

The Garfield Rolls Developed

Fig. 19 illustrates the Garfield-type rolls, made by the Worthington Pump & Machinery Corporation, which are in use in many of the leading mining plants and may be classed among the most powerful machines for crushing on the roller principle. Construction is similar in essentials to that adopted for the Gates High-Grade rolls, Fig. 11. The bearings are of the one-piece swiveling pattern, and the sliding carriages for the pillow blocks are designed on the usual lines. Thrust collars are split to clamp into grooves in the ends of the shafts and screw on the ends of the solid bearings with latches to lock them in position. This figure shows both pulleys on the same side of the mill, a system of driving which is applied at times to various makes of rolls, giving greater freedom for safe access to the rolls and bearings when the machine is at work, and enabling the pulleys to be set to clear the adjusting collars without excessive overhang from the bearings. With belt drives on both sides it is sometimes dangerous to attend to the lubrication at proper intervals.

In addition, the fixed-roll shaft is extended and supported in an outboard bearing, not shown in the figure, which is set on folding wedges on a heavy soleplate so that the level and line of this pedestal can be changed in agreement with the wear on the roll bearings. This arrangement also permits the use of a heavy flywheel pulley on the fixed-roll shaft. It is of considerable advantage when crushing under certain conditions, such as the choke feeding of hard ore.

Continual advances in the size of the rolls and their operating speed necessitated great increases in spring pressure to meet the shocks and impacts inseparable from high velocities and choke crushing. In the early days of spring rolls a pressure equivalent to 4,000 lb. per inch width of face was considered perfectly satisfactory. As time went on and rolls increased in diameter, this figure grew to 12,000 lb. per inch, and, in modern machines with rolls 5 or 6 ft. in diameter, the pressure now reaches 30,000 lb. per inch, and this limit may be exceeded in the near future.

With the increase in strength of the springs, the defects in the single tierod system for transmitting the pressure to the bearings for the movable roll became more pronounced, and led to the reintroduction of the double tiebar type, despite the drawbacks inherent in this form of construction.

At present the C. G. Buchanan Company is making rolls, as shown in Fig. 20, fitted with springs capable of exerting a pressure of 30,000 lb. per inch width of face. The bearings are split with renewable lower castings, and the upper tierods rest in U-shaped slots in the frame pillars, so that, on freeing the nuts, the long bolts may be lifted to gain access to the bearing caps and rolls. Owing to their high spring pressure, these rolls are practically rigid when crushing the hardest ores, and, with their heavy shafts and large bearings, they are capable of satisfactory operation at a pheripheral speed of more than 1,500 ft. per minute, thus making the crushing of high tonnages possible.

Among the later examples of high-speed crushing

machines the "Ajo" type rolls, made by the Traylor Engineering and Manufacturing Company, illustrated in Fig. 21, must be regarded as the largest and most powerful narrow-faced rolls built at present. These large rolls measure 78 in. diameter by 24 in. wide, and the shells are 9 in. thick, weighing 13,250 lb. each. The four tension rods are 7½ in. in diameter and the spring pressure 15 tons per inch width of face. The pulleys are 10 ft. in diameter, of 21-in. face, with flywheel rims and steel-plate centers, both shafts being fitted with equal pulleys and both driven by separate motor. (In one plant the motors are each 250 hp.) The bearings are of the solid self-aligning type and are fitted with dust-excluding devices, the shafts being 21½ in. in diameter at the journals and 22 in. in the body. It is said that, when running at 120 r.p.m., these rolls are capable of reducing 3-in. stone to a finished size of half an inch and under at the rate of 400 to 500 tons per hour and that their performances as units in some of the largest crushing plants have been remarkable.

The effect of choke feeding across the full width of the face coupled with the large diameter and gripping power of the rolls, has reduced the tendency for the shells to form circumferential corrugations, and, assuming the steel is of equal density throughout, the wear is regular and even. Some difficulty still remains, due to "flanging," to overcome which a special form of cheek plate has been introduced.

The success of these large high-speed rolls has led to a simplification of the flow sheets in many extensive milling plants. The problem of deciding on the best machines for the second- or third-stage reduction has always been a difficult one, more particularly where large tonnages have to be handled. Given some guarantee as regards reliability and continuity of operation, engineers undoubtedly prefer to avoid complicated plants, with their multiplicity of parts. It is safe to prophesy that the roller crushers have not yet reached the limits of maximum size and capacity.

By the Way

Not Left on the Shelf

CALLERS on an executive of one of the large corporations engaged in the mining and smelting of non-ferrous metals, after passing the guardian of the outer office, find themselves in a small anteroom just outside the official's door. In it are a couple of chairs and a table. One of the editors of *Engineering and Mining Journal,* who passes through the room every Wednesday morning, has noticed that a copy of the most recently bound volume of the *E. & M. J.* invariably lies on the table. Finally his curiosity was aroused to such an extent that he asked the executive the reason for keeping the volume there. The reply, in substance was this:

"I used to keep a small collection of the current magazines on the table for the diversion of a caller, if it happened that I had to keep him waiting. A couple of years ago I hit upon the scheme of replacing these with a bound copy of *E. & M. J.* The periodicals were always scattered around and made the place untidy. Likewise it frequently happened that someone would—either accidentally or on purpose—carry away the current copy of the *E. & M. J.* Moreover, it was quite troublesome keeping new numbers of the various magazines on hand. The present scheme overcomes all of these objections. A change is necessary only once in six months; and the atmosphere of a dentist's office is avoided. And if a visitor cannot find plenty to interest him in a half-year of the *E. & M. J.,* I don't care much whether I see him or not."

* * *

"Dead Heart of Australia" May "Pulsate"

IN TIME the sun-baked wastes of the "dead heart of Australia" will perhaps be made to pulsate with energy, as providing one of the most favorable regions in the world for trapping the energy of solar radiation by means of sun engines, states a writer in *Chemistry and Industry.* Ackermann's experiments with parabolic reflectors at Cairo, in 30 deg. N. latitude, have demonstrated the possibility of securing 60 hp. per acre of earth surface in this way. The loss incurred through the angle of incidence of the radiation is here only 13 deg., and in Australia it would be sensibly less, as the continent lies mainly to the north of latitude 30 deg. S.

Consultation

No Market for Carnotite Ores

"Will you be so kind as to advise us how the market is for carnotite ore ranging from 2 to 3 per cent U_3O_8 and 5 per cent and more of V_2O_5? What prices are being paid for such ore in carload lots? Can you refer us to a market or to one you think might be interested?"

Correspondence with those who might be interested reveals that there is practically no market in the United States for carnotite at present. The market has been unsettled ever since the discovery of pitchblende radium-bearing ores in the Belgian Congo. Carnotite ores cannot be worked commercially for their uranium and vanadium contents alone, and the price of radium is not sufficiently high at present to warrant the treatment of domestic ores. Ores containing an appreciable amount of vanadium, however, might be sold to the Vanadium Corporation of America, 120 Broadway, New York, if regular shipments of sizable quantities can be satisfactorily guaranteed.

* * *

Precision in Weighing

"I am much interested in the conditions under which assayer's gold button balances, having a sensivity of 0.002 mg., must be placed and operated to reduce as much as possible the difficulties resulting from drifting of the zero point while weighing."

Readers who have had interesting experiences in their efforts to obtain precision in weighing are invited to contribute. The inquirer is aware that a paper entitled "Precision in Chemical Weighing," by W. N. Rae and J. Reilly, appeared in *Chemical News,* Vol. 114, pages 187 and 200, 1916; also that various studies of the subject have been made by J. J. Manley, one of them having appeared in *Transactions* of the Royal Society of London, Vol. A 210, page 387, 1910. Other sources of data are desired.

DISCUSSION

Concentrate Smelting Practice

THE EDITOR:

Sir—I am surprised to read in your issue of Jan. 21 (p. 123) the following by E. H. Robie, in discussing the smelting of copper concentrates: "This work recalls the tests that were carried out some years ago at Anaconda[1] by Messrs. Klepinger, Krecji, and Kuzell, in which concentrates were blown into a converter. Though successful in many respects the practice has never been carried out on a commercial scale." Surely the writer is more familiar with actual practice than this statement would indicate. In the Oct. 1 issue of *E. & M. J.* (p. 552), in reviewing the discussion at the Salt Lake meeting of the A.I.M.E. on the effect of flotation on metallurgical practice, I wrote as follows: "F. J. Longworth, of the Tennessee Copper Company, stated that for four years his company had been smelting all its concentrates direct in a Peirce-Smith converter, using the Garr gun to feed it, and that the ratio of concentrate to matte was now one to one, some 80 tons of each being smelted daily. The concentrates are not dried or roasted and contain 8 to 10 per cent moisture and about 12 per cent copper. The dust loss is very small—less than it would be in roasting this same concentrate. There is no boiling and no explosion when using the Garr gun. The 'insoluble' in the concentrate is 5 to 6 per cent, and additional siliceous flux is introduced just as in ordinary matte blowing. The recovery, concentrate to blister, is over 96 per cent. Further details of early work are given in an earlier paper[2] by Mr. Longworth."

This practice was actually started in February, 1923, on a commercial basis. In the earlier article quoted, Mr. Longworth says: "From the first this method of treating concentrates has been a success."

In an extensive discussion of the effect of selective flotation on metallurgy, published in the *Black Hills Engineer* of January, 1927, assuming that it was generally known that copper concentrates were being smelted in converters, I asked this question: "Shall we see a gradually increasing amount of these high-copper concentrates smelted in the converter, up to the point where the heat in the converter is insufficient to melt the cold concentrates?" Again, in discussion of Mr. Tye's paper on "The Effect of Preferential Flotation at Cananea Mill and Smelter" at the aforementioned Salt Lake meeting, I again called attention to this phase of copper metallurgy, which elicited the remarks above credited to Mr. Longworth. Hence my interest in asking that you correct as soon as may be the false impression conveyed in Mr. Robie's article.

L. O. HOWARD.

Pullman, Wash.

I am glad that Mr. Howard has called attention to this temporary (I hope) mental aberration of mine in the Annual Review number, so that it may be corrected. Unfortunately, I find, on looking up what I said, that I made not two, but three errors in two successive sentences, though such a high concentration is perhaps less to be censured than to have the virus of untruth permeate the entire article. The work to which I referred was done at Great Falls—not at Anaconda; and it consisted in blowing concentrates into a reverberatory furnace, not into a converter. But whether into a reverberatory or converter, the same type of work has since been done by others, Trail and Cananea using a reverberatory, and Tennessee using a converter. I cannot plead ignorance of the Tennessee practice, for I believe that I was one of the first, if not the first, to call public attention to it. On page 110 of the *E.&M.J.* for Jan. 19, 1924, I said: "Experiments made at Tennessee on the blowing of concentrates into a converter with the Garr gun have been very successful, and it is now regular practice."

Now comes the question as to the conditions that govern whether a concentrate should be roasted and smelted in the regular way, blown into a reverberatory, or blown into a converter. The Tennessee folks will probably say that they blow them into a converter because there is no reverb on the premises. Will not some of our readers discuss this matter further?

E. H. ROBIE.

[1] I believe the tests as a matter of fact were made at Great Falls and not Anaconda.

[2] F. J. Longworth: "Smelting Copper Concentrates in a Converter." *Trans.* A.I.M.E. (1925), Vol. 71, p. 969.

The Tariff on Tungsten

THE EDITOR:

Sir—The news comment from Washington in your issue of Nov. 19, 1927, seems unfair and misleading to the tungsten producers and prospectors of California, as it referred to the number of men employed in the production of tungsten in 1926, but did not mention the hundreds employed in prospecting for and developing tungsten properties in that year. It is a well-known fact, moreover—or should be—that many more men were working in the tungsten industry in 1927 than in 1926.

I am inclosing a letter, written to the Tariff Commission on Jan. 3, 1928, which expresses a view on the question of removing the tungsten tariff, different from that in the news comment referred to. If it is not inconsistent for you to do so we should appreciate it if you would publish an article showing phases of the tungsten industry other than the number of men employed.

It seems to us that more publicity should be given to the attempt to reduce the tariff on tungsten, manganese, and other minerals, which is being made at this time, apparently for the benefit of the large interests alone.

My letter to the Tariff Commission follows:

"Gentlemen:

"The news comment from Washington in the *Engineering & Mining Journal* of Nov. 19, 1927, page 136, entitled 'The Duty on Tungsten,' I believe to be altogether misleading, and it should be disregarded in any investigation of the duty on tungsten ore by the Tariff Commission. The number of men employed is not the only factor entering into the cost or other elements connected with the tungsten industry in the United States.

"Hundreds of thousands of dollars are tied up in the development of mines and mills for the treatment of tungsten ore, with more mines being opened up and more mills being erected, all of which will be a dead loss if the tariff should be removed, as it is impossible to compete with Chinese and Malayan labor, which is being used in producing tungsten in the Orient.

"As to the sentence in said news comment, 'The known and prospective amounts available in the United States are very small,' it is also misleading, as there is tungsten in seven western states, in paying quantities. Few prospectors know the ore when they find it, but they are beginning to learn to recognize it now.

"The greatest handicap that the tungsten industry has to contend with has been the refusal of the metal brokers and large steel interests to buy less than carload lots of ore or concentrates assaying 60 per cent WO_3.

"It would appear as though the large steel interests discourage, intentionally, the small operator, since the tariff was placed on tungsten with the intention of keeping the American production

down, and are now trying to have the tariff taken off.

"We can produce enough tungsten in the United States to supply the demand, in a short time, and have the mines opened up and mills built, on a scale to make us independent in case of war; but with the tariff taken off, the mines will have to close down, prospecting and development will cease, and the mills will have to be sold for junk, or moved, and if trouble should come, we will be just as we were in 1915—no ore in sight, with the price sky high.

"We have 9 sq.mi. of tungsten-bearing ground in one block, here in the Pinal Mountains, about 10 mi. south of Globe, with tungsten ore opened up in prospect shafts and tunnels, and have had mill tests and analyses on the ore, and have a mill partly completed.

"We have to pay miners $5 a day of eight hours, while the Chinese miner works for 25c. in Mexican money, and works long shifts.

"I think the tungsten producers and prospectors should be given time to present the true facts in their behalf, before any action is taken toward removing the tariff, which would benefit only the large manufacturers of steel. (See also *Engineering and Mining Journal* of June 5, 1926, page 934; and the article in the issue of Jan. 22, 1927, page 131, by Frank L. Hess, of the Bureau of Mines, Washington, D. C.)."

C. JEROME CLARK.

Globe, Ariz.

[Our readers will appreciate the fact that news comment from Washington, published in *Engineering and Mining Journal*, does not necessarily coincide with an editorial attitude on a matter of this character—EDITOR.]

Progressive Railroads and the Mineral Industry

THE EDITOR:

Sir—In your editorial, "Progressive Railroads and the Mineral Industry," in the Jan. 7 issue, you specifically mention three railroads that are maintaining organizations to encourage mineral development in their territories, although you state that others are carrying on the same work. May I call your attention to the fact that another large trunk line, the Missouri Pacific Railroad, initiated work of this character on its lines a year and a half ago, as a branch of its Industrial Development Department?

The original purpose was to promote the development of mineral resources by determining the location and character of these resources and bringing them to the attention of investors who might be interested. This is still the main purpose, but the work has broadened in scope and branched into various ramifications. It has become, in a way, a service, not only for prospective new development, but to present operators, especially those carrying on small operations who do not have, or cannot afford, specialized technical advice. Care is taken not to encroach on the proper field of the consulting engineer. In fact, the advice often given is to secure the services of a specialist in the particular field involved. This department is often called upon by the owner of a property to make an examination of his mineral deposit, with the idea of interesting investors. A brief examination usually indicates whether the deposit has merit and is worthy of careful investigation. If it is, advice is given as to how the owner should develop it. On the other hand, considerable diplomacy is often needed to explain to the owner, without offending him, that a cheap, non-metallic mineral commodity some miles from the railroad is worthless.

Considerable work is done in assisting operators in finding markets and expanding the uses of their product.

Many promoters, both good and bad, come to the higher officials of a large railroad, with propositions that promise tonnage, with the idea of securing the moral support and encouragement of the railroad. These officials, while splendid business men from a transportation standpoint, are not trained to judge the merits of a mining venture, and the Mineral Technology Branch is called on for advice as to the chances of success of the proposition. Also, the work of the rate-making department of the railroad is often facilitated by calling for technical advice and information when commodity rates on minerals and mineral products are asked for.

Laboratory tests and chemical analyses are not made by the department for interested parties, but samples of minerals sent in are identified and advice is given as to their probable value, and every legitimate assistance is afforded to make development possible.

St. Louis. W. M. WEIGEL.

A Bow to J. H. Farrell

THE EDITOR:

Sir—Of the many stimulating and excellent articles provided by your esteemed journal, I have of late read nothing that quite compares with Mr. J. H. Farrell's clear-cut, exhaustive and most instructive contribution in your issue of Jan. 7. I have read and I have reread it because the points he makes —and they are many and varied— strike home, forcibly, bring back to memory, from experiences in various countries, facts and incidents almost analogous from about every standpoint; from varying personal as well as technical angles. Where so much is excellent and the field itself so wide, I will content myself with quoting one twice-stated dictum, that: "The geologist's work, to be of most value, should be carried on regularly during the life of a mine" at the bottom of the third paragraph, p. 12; and, in the final paragraph of p. 14: "The work should continue from year to year." How wholly obvious a provision; how largely neglected by mining companies!

A. SPENCER CRAGOE.

Liskeard, Cornwall.

Emergency Preparation of Xanthate

THE EDITOR:

Sir—In your issue of Dec. 24 appeared a note on the emergency preparation of potassium xanthate. I induced H. Frey to repeat the preparation in his laboratory, whereby we found the following deficiencies:

1. The amount of alcohol was too small to dissolve all the caustic alkali. By heating on the water bath, a sediment remains that certainly may be decomposed by direct heating.

2. The adding of more alcohol takes too much time and combustible to reach the point when the coagulation of a white solid is produced. But we observed that the solid mass referred to is obtained more quickly and more easily by cooling the flask in running water.

3. Heating after adding the carbon disulphide and condensing the vapors with a reflux cooler is out of place, because the reaction is instantaneous and accompanied by a considerable rise of temperature.

4. By washing the end product with alcohol for purification, it will be found that xanthate is easily soluble in alcohol. For that reason I prefer to dissolve it at once in alcohol and distill the excess.

Various methods have been tried by us, and we recommend the following ones for high extraction and rapidity of manipulation:

Well known is the procedure given in my book, "Der Flotations-Prozess," p. 16. Prepare by gently warming an alcoholic solution of caustic alkali, cool and shake with carbon disulphide added in small amounts. A yellowish salt is formed that remains after evaporation of the alcohol on the water bath.

The method given by Dr. H. Hirzel is as follows: To a solution of 1 part CS_2 in 20 parts alcohol free from water, add gradually caustic potash finely pulverized, stirring continuously, until on removing a small quantity and diluting it with water only a weak cloudiness is shown. Then the solution is filtered; and the filtrate, in a stoppered bottle, is cooled in ice. Beautiful hair-thin crystals of silky lustre are obtained.

The quickest and best extraction method was discovered by Mr. Frey: To a solution of 50 grams caustic alkali in 300 cc. alcohol free from water is added gradually a solution of 70 grams CS_2 in 140 cc. of alcohol, stirring vigorously. The stoppered flask is cooled in running water and set aside. In the course of about half an hour the xanthate will crystallize as a yellowish mass. If it is deemed necessary, a wash may be given with ether, and from the remaining mother liquor the excess alcohol is distilled on the water bath to recover any xanthate left behind. The reason is that only solutions showing a much speedier chemical velocity of reaction, on account of the more homogeneous distribution of their reagents in the liquid, partake in the transformation.

C. BRUCHHOLD.

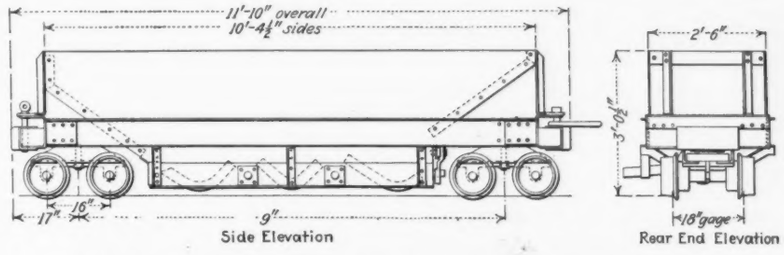
Mexico.

INDUSTRIAL PROGRESS

The Equipment Review

NEW machinery recently introduced by manufacturers for mining and metallurgical use is described briefly in the following:

Transport—An automatic bottom-dumping car designed for use on narrow-gage tracks has been introduced by the Sanford-Day Iron Works, Knoxville, Tenn. This car, which is known as the "S & D Griffith automatic drop-bottom car," is shown in the accompanying drawing. It is of large capacity. By bringing all of the dumping space between the trucks lengthwise of the car the manufacturer has been able to get more dumping space crosswise of track than can be done in the ordinary drop-bottom car of four-wheel design where doors are hinged to the car axles. This is true because in the ordinary four-wheel design, where doors are hinged to axles, the axle boxing must be attached to the side framing channels, and these channels take up some of the dumping space. The manufacturer states that at the dumping place, if the rails have the inside flanges planed off or if an angle iron serves as rails, the doors can be made a little wider and thereby provide a little extra space crosswise of the track. An advantage of this eight-wheel construction is the ability of the car to negotiate short curves. However, automatic operation of the doors is the special feature. The doors are opened automatically with a special device placed at the side of the track, and closed again with a special device placed between the rails.



Another automatic bottom-dumping car for narrow-gage track

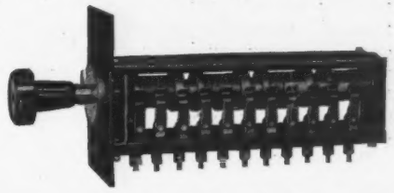
Haulage—A cross-equalizing device that gives an additional advantage to its gasoline locomotive has been perfected by the George D. Whitcomb Company, Rochelle, Ill. This consists of a cross-bar centrally pivoted on the front of the frame so that any excess load on either front spring is compensated for by the oppositely operating action of the crossbar. The action is equalizing in that it distributes the load equally to both front springs and thus maintains the rail-load in constant balance. This equalizing device tends to keep the weight of the locomotive in constant balance, so that it rides rough tracks safely and more smoothly than it would otherwise do. The device gives the locomotive to which it is applied an absolute three-point suspension.

A new trolley clamp has been introduced by the Ohio Brass Company, Mansfield, Ohio. This is designed to carry a 4-0 feeder wire directly above the figure 8 or groove wire, which eliminates the necessity for the more costly, complicated overhead construction. After being screwed onto the hanger, tightening or loosening the head nut causes the jaws of the clamp automatically to grip or release both wires, which assures a quick, easy job of installation or removal. This clamp can also be used to advantage, it is claimed, where the feeder wire will be installed later. In such cases the worn trolley wire may be slipped up in the clamp and used as a feeder wire before the new trolley wire is strung. The companion setting, the catenary clamp, which is an essential where the dual Bulldog is used, is placed in the span between clamps to serve as a current path and as a steadier for the two wires.

It will not be amiss here to mention the new 2,000-hp. Ljungstrom turbine locomotive recently developed in England for railroad haulage. It was constructed by Beyer, Peacock & Company, of Manchester. The locomotive consists of two units. The front one, which carries the cab, is devoted to the boiler plant and consists mainly of a boiler of the Belpaire type, designed for working pressure of 300 lb. per square inch. An interesting feature is that the induced draft is operated by a steam-turbine-driven fan located in front of the smoke box. The power unit consists of the main turbine, which is geared to the main driving axle; the condenser; the turbine centrifugal feed pumps; and accessories. Superheated steam is used. The efficiency of the power plant compares favorably, it is said, with that of any other steam-turbine plant of approximately the same size. The locomotive consumes less fuel than standard express locomotives of considerably lower haulage powers, and, as the steam is condensed, can be run for long distances without replenishing the feed-water supply. It has a high starting torque, as well as perfect balance at all speeds. With full load it has a total weight of about 144 gross tons and can develop a drawbar pull of more than eighteen tons.

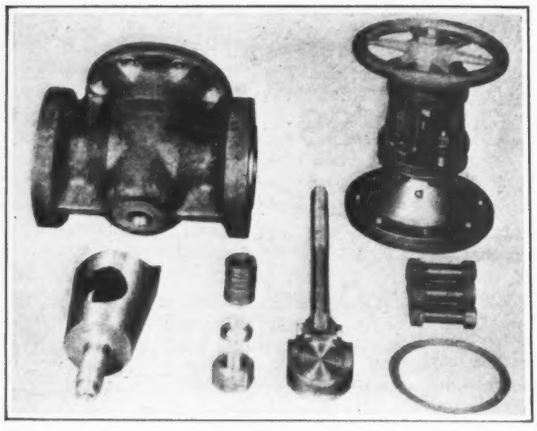
Motors, Switches—A new type of switch, used for connecting any instrument or group of instruments selectively to various circuits as may be required for metering, synchronizing, or for other switching functions, has been introduced by the Westinghouse company. It is of the rotary type. It is especially adapted to mounting in small space. It may be used on any commercial thickness of panel. The Type W instrument switch is shown in the illustration.

The same manufacturer has introduced also three new drum switches for use with squirrel-cage and slip-ring motors. These have been designed particularly for controlling small cranes, hoists, machine tools, and the like.



Instruments, grouped or singly, may be connected selectively to various circuits with this switch

The Power Plant—A new lightweight, high-speed Diesel engine has been introduced by the Buda Company, Harvey, Ill. This is known as the M. A. N. Diesel and is intended for operation of shovels, cranes, compressors, pumps, locomotives, and hoists, as well as other equipment. All the operating features of a heavy-duty gasoline engine are claimed for this new Diesel, with the added advantage of low fuel cost. Fuel is injected into the cylinders without the aid of compressed air, thereby giving lightness and greater simplicity. The fuel pumps are arranged to meter fuel in proportion to



This new valve is intended for high-temperature and high-pressure service

the speed and power required, a feature which is said to eliminate the high acceleration stresses and insures smooth, quiet operation. Fuel having a Baumé gravity of approximately 26 to 38 can be used. Force-feed lubrication is employed. The 6x8 engine of this type is rated to develop 92 b.hp. at a normal speed of 1,000 r.p.m. and is arranged for ledge or three-point mounting.

A new heat exchanger and cooler has recently been developed for handling dirty or corrosive liquids and gases. This apparatus, called the G-R Tubeflo section, is said to be applicable for severe conditions where other types of coolers would rapidly deteriorate. The new exchanger is made entirely of semi-steel to withstand corrosion. All fluid passages are straight, smooth, cored holes which are readily cleaned. The parts are interchangeable. The maker is the Griscom-Russell Company, 285 Madison Ave., New York.

Valves—A new type of valve for high-pressure and high-temperature service has been developed by the Wellman-Seaver-Morgan Company, Cleveland, Ohio. It is known as the Wellman Supertest valve. Differing from previous types, this valve has seats which are an integral part of a slightly tapered removable valve cage. The cage has an external take-up adjustment to compensate for expansion or contraction and to prevent leakage between the walls of the cage and the main valve body. See the cut above.

Another feature is that the valve cage may be used to shut off the flow through the valve while repairs or adjustments are being made, entirely eliminating the necessity of taking the entire valve body out of the line. When repairs are necessary, the cage needs to be rotated only a quarter turn to prevent the passage of fluid and permit the removal of the internal parts. The gate faces are removable and may be replaced when worn or adjusted when desired. Cages, gates, gate bolts, stems, bushings, and gate seats are of stainless steel. The valves conform to dimensions approved by the American Society of Mechanical Engineers Standards Committee for steel-pipe flanges and flanged fittings. The globe valves of this new model are made in ¾-in., 1-in., 1½-in., 2-in. and 3-in. sizes. The gate valves are made in 1-in., 1½-in., 2-in., 3-in., 4-in. and 6-in. sizes, and it is said that larger sizes up to 24 in. can be supplied.

Instruments—A new instrument for recording time and duration of events has been introduced by the Esterline-Angus Company, Indianapolis. This instrument has a wide range of uses, it is said, in recording operations and elapsed time and for graphic counting. It may be had in portable cases or cases for switchboard or wall mounting.

A screw jack built with an open handhole

The Brown Instrument Company, of Philadelphia, has announced that it is now able to furnish its continuous strip chart instruments in cases of the flush type. It has long supplied its pressure gages, thermometers, and more lately its flow meters in circular cases of this type. A feature of the new chart recorder permits the recording mechanism to be taken out of the case at the front for easy inspection.

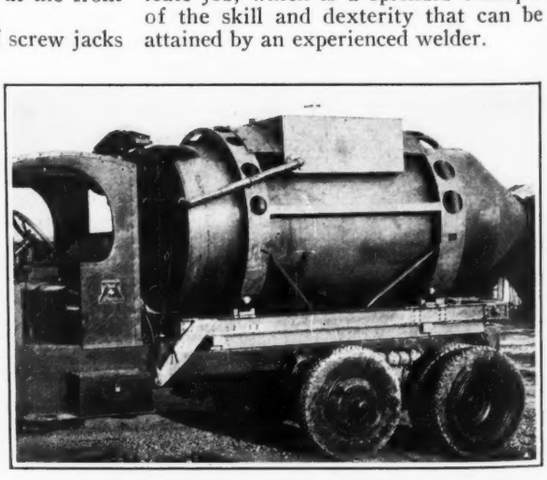
The Shop—A new line of screw jacks with certain improvements has been announced by Templeton, Kenly & Company, Ltd., 1020 S. Central Ave., Chicago. These jacks are built with an open handhole, permitting the screw to be visible at all times. The line comprises 32 different sizes.

Construction — The concrete mixer shown, mounted on a truck, in the accompanying cut is known as the Paris Transit mixer. This is a patented mixer of the rotary type made by the Transit Mixers Company, Inc., Call Building, San Francisco. Under certain circumstances it might be found of use by mining companies having construction work to do at some distance from the plant. The interior of the shell of this mixer has an ingenious arrangement of blades, breakers, and baffles, by means of which a homogeneous mix may be produced rapidly. The mixer may be mounted on any standard truck from 3½ tons upward. Power that drives the truck is used for revolving the drum.

In operation, the pre-measured batch of dry aggregates and cement is dumped into the drum while rotating, this to secure the dry mix, at the material dealer's bunker. A pre-measured quantity of water is then run into one of the saddle tanks on the mixer. The other tank is filled with water to be used in flushing the drum after concrete has been poured. The truck is then driven to the job. En route to or at the job mixing is started by the truck driver through the operation of triple levers. On arrival the drum is elevated by means of any type of standard hoist that may be employed and the concrete is poured.

The Smallest Weld

An oxyacetylene welding blowpipe which produces a flame temperature of over 6,300 deg. F. was used by an expert welder to repair a tiny broken link in his watch chain. The oxyacetylene flame is usually employed for welding thick steel and iron. A steady hand and a keen eye were required to manipulate the blowpipe for this delicate job, which is a splendid example of the skill and dexterity that can be attained by an experienced welder.



Concrete may be mixed in this mixer while en route to the job

NEWS OF THE WEEK

Summary

FIRE at Premier mine, in British Columbia, destroys bunkhouse, store, cookhouse, and other buildings with an estimated loss of $100,000.

* * *

On page 343, story of the record-breaking trip of Mine Rescue Car No. 3 from Pittsburgh to Timmins in 21 hours, arriving too late to save lives, but effectively quelling the fire that killed 39 men at the Hollinger.

* * *

Treadwell Yukon plans the erection of a 200-ton flotation plant at Tybo, Nev., to treat ore carrying lead, zinc, and silver.

* * *

Mexican government has not received a single application for shutting down a mining property in several weeks. This is generally considered an indication of improved practice and settled labor situation.

* * *

Transvaal sees 4,000 runners line up for rush at Grasfontein in what may be the last of these picturesque events held in South Africa.

* * *

Four diamond drills are being operated at Amulet, in the Rouyn district. Drilling so far has disclosed a good-sized body of zinc.

* * *

Hollinger mine resumes activities six days after fire which killed 39 men first broke out. Inquiries into the cause of the fire are being made by the coroner's jury, a government commission, and the company itself.

* * *

P. K. Horner reports to Minerals Separation on the Rhodesian metal mining situation.

* * *

According to the decision of Judge Bourquin, in the Anaconda-Metals Recovery suit, the use of xanthate in flotation antedates the Perkins patent.

* * *

Two men lose their lives at United Verde Extension when cage crashes into water at the bottom level of the mine.

Turner and Smith in Conference with Senate Mines Committee

Value of Science and Engineering to Mining and Need for Government Aid Emphasized

By Paul Wooton
Special Washington Correspondent

THAT more aid from science and engineering is the crying need of the present-day mining industry was brought out strikingly on Feb. 16, before the Senate Committee on Mines and Mining.

"Increasing draft upon irreplaceable deposits," Dr. George Otis Smith, the Director of the U. S. Geological Survey, told the committee, "and the depletion of a fixed reserve, create the problem of the mining engineer. The solution can be simply stated. There are two and only two ways of adding to the country's available mineral assets —by getting a larger recovery from known deposits and by finding new deposits. To keep up the pace already set by the demands of civilization today—not to mention the demands of tomorrow—we need to apply to our task more and better technology and more and better geology. Therein lies the mining industry's need for more science and engineering."

Senator Oddie, the chairman of the committee, called the members together for a discussion of the problem presented by the apparent indifference of Congress toward the mining industry. He has been pointing out for years that it is in the public interest for the government to co-operate to a greater extent with the mining industry. This year he proposed to increase the appropriations at the seven existing Foster experiment stations from $25,000 to $50,000 and to Fosterize two additional stations. The Appropriations Committee discarded this bill with scarcely the courtesy of an explanation, despite the fact that the measure had been reported favorably by the Committee on Mines and Mining. It was this situation that led Senator Oddie to call before the committee the Director of the Geological Survey and the Director of the Bureau of Mines to build up a record showing what the federal government can do in extending the scientific and engineering aid needed.

"To mining engineers the volume of output, though less easily determined in country-wide statistics, is far more significant as a measure than the value of output. The Harvard index of physical volume of production for the several industries probably furnishes the best available expression of the contribution which our mines make to the country's growth. The tons of raw materials shipped, not the dollars collected, is the true measure of service rendered.

"The Harvard index curve for mining begins with 1879—like the U. S. Geological Survey, which furnished the statistics of production. For the next four decades this index records a remarkably steady increase, the volume of mineral output in the war years reaching a maximum of nearly twelve times that of 1879. In these four decades the population had only a little more than doubled. This rate of population increase was practically paralleled by agriculture.

"Nor did the phenomenal development of this country's mines stop with the letting down of the special war demand. If now we shift our base for the index of production from that far-off period of our industry's youth and start with 1919 as the beginning of the era in which we live and work, we find that in eight years the mining industry increased its physical output nearly 40 per cent, a rate almost equal to that for the same number of years culminating with the war peak.

"It is the ever-mounting curve of mineral consumption indicated by these figures that I interpret as peculiarly expressive of increments in civilization. The contrast between mining and agriculture is significant in two respects. In the first place, with reference to demand, one generation requires about as much food per capita as another, but its requirements in the stuff that civilization feeds on—metals, fuels, and building materials—change with every discovery and invention. In the second place, with reference to supply, mining is a process of depletion, whereas agriculture harvests annual crops, or, as Professor Day puts it in describing his index of mining output, 'mining typically lives upon its capital; agriculture, upon its income.'"

In response to questions by Senator Oddie, Director Turner of the Bureau of Mines said that the value of the annual mineral production of the United States is about $6,500,000,000, which compares with $3,500,000,000 in 1916. He explained that he did not have definite figures for other commodities, but believes that the value of the annual agriculture production is $13,000,000,000; that of forest products, $1,000,000,000; and that of fisheries $90,000,000. He quoted Secretary Hoover to show that when the raw materials of our mines emerge from manufacture with the added expenditure of labor and capital upon them, they have a wholesale value of over $15,000,000,000, and their total value when delivered to the consumer exceeds $20,000,000,000. When the products of agriculture reach the consumer they have about the same value as the products of mines—each of them contributing about one-quarter to the total national income.

Senator Oddie questioned Director Turner in connection with the widespread complaints which are being formally made throughout the West because of the failure of the federal government to perform those functions for which it is peculiarly fitted. Mr. Turner replied that he had received numerous complaints from sections of the American Institute of Mining and Metallurgical Engineers and from other organizations. Senator Oddie explained that he had called upon the Secretary of Commerce and the Director of the Bureau of Mines to furnish copies of such communications and submitted a large number of them to be printed in the record of the hearing.

Senator Oddie discussed the request made to the President by 32 of the leading mining engineers of the country with regard to the need for a world survey of mineral resources. He inquired into the situation with regard to the strategic minerals and the requests for service in that connection that had been received from the War and Navy departments.

In response to a request from the committee, Director Turner prepared a table to show the extent of the reductions which had been made in the amounts he originally asked for mining work. Senator Pittman, of Nevada, inquired closely into the qualifications of the budget and other officers to pass intelligently upon the needs of the mining industry. He pointed to the generous treatment of requests for research work on agricultural and other problems and declared that requests from the mining industry were accorded no such treatment.

Bureau of Mines Appropriations

Appropriation Item	Bureau of Mines Appropriations for 1928	Preliminary Estimates of Bureau as Submitted to the Department	Bureau Estimates as Revised After Conference with Department	Bureau Estimates Authorized by Department to be Submitted to Bureau of Budget	Bureau of Mines Final Estimate as Authorized by Bureau of the Budget
General expenses	$86,000	$93,500	$91,000	$88,500	$86,000
Investigating mine accidents	386,470	566,470	500,470	414,470	399,470
Mining investigations in Alaska	10,860	11,260	10,860	10,860	10,860
Operating mine rescue cars and stations	327,630	436,380	361,630	392,630	342,630
Testing fuel	154,000	231,000	219,000	158,500	158,500
Mineral mining investigations	99,570	165,570	186,570	127,070	125,000
Oil, gas and oil-shale investigations	198,260	275,000	231,960	198,260	198,260
Oil-shale investigations	5,000	.....	.....	125,000	80,000
Expenses mining experiment stations	173,000	305,000	223,000	173,000	173,000
Care and maintenance of buildings and grounds, Pittsburgh	71,360	182,500	154,000	76,360	76,360
Maintenance and operation, government fuel yards	Balance	Balance	Balance	Balance	Balance
Helium investigations	75,000	78,000	75,000	75,000	75,000
Helium production and conservation	1,063,000	905,000	905,000	905,000	462,000
Potash investigations	100,000	100,000	100,000	100,000	100,000
Economics of mineral industries	225,000	365,000	355,000	305,000	275,000
Total	$2,975,150	$3,714,740	$3,414,490	$3,149,650	$2,562,080

Douglas Mine Has Small Fire Loss

Fire of unknown origin caused damage of about $10,000 at the Douglas mine at the head of Pine Creek, 10 miles from Kellogg, recently, according to recent reports. The compressor, motor, hoist, blacksmith shop, and compressor house and a quantity of tools in the buildings were destroyed. Underground work has been suspended until a new hoist and equipment can be secured. The loss was covered by insurance. The Douglas mine is controlled by the Bunker Hill & Sullivan Mining & Concentrating Company. At one time it was the property of Anaconda Copper Mining Company.

Mechanical Shovel Aids in Making Record Tunnel Drive

In the article in the news pages of *Engineering and Mining Journal* of Feb. 11, detailing the progress made in driving the mile-long tunnel at the property of the Compañia Minera de Peñoles, S. A., at Mapimi, Durango, Mexico, omission was made, in crediting the performance to the use of improved machinery, of the statement that one of the most important factors in producing the results recorded was the Butler shovel of the Nordberg Manufacturing Company, which was used for mucking operations. The omission was entirely inadvertent, and is herewith compensated.

Hollinger Resumes Operations Six Days After Fire

Work Being Done Consists Largely of Removing Refuse from the Lower Levels

HOLLINGER has resumed operations at its mine in Timmins, Ont., the scene of the fire that caused the loss of 39 lives recently. Damage caused by the fire was greater than had been estimated. It is probable that for some time work will be confined to repairing the damage and removing all inflammable rubbish from the underground workings.

Fire broke out in the 511 and 512 crosscuts near No. 11 shaft on Feb. 10. The fire was not under control until the afternoon of Feb. 12, after the rescue car, sent by the U. S. Bureau of Mines, had arrived. Of the 51 men who were trapped underground, 12 were saved, the others dying as the result of carbon monoxide gas which swept through the mine. A coroner's jury was promptly made up, and inquiry into the causes of the disaster started. Both the government and the company announced their intentions of making investigations.

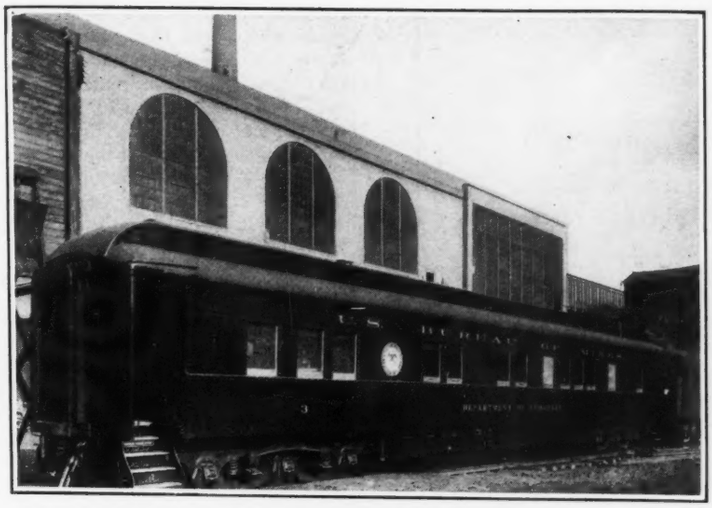
On Feb. 16, the same day that work was resumed, the coroner's jury inspected the scene of the fire, and also other places in the mine where it was thought there might possibly be rubbish heaps similar to the one in which the fire started. Investigation disclosed four such heaps, all composed of mine refuse. It is said that these dumps were unknown to Government Inspector Sutherland and his assistant. As soon as these discoveries were made, the inspector ordered them to be flooded.

Justice T. E. Godson, Judge of the Mining Court of Ontario, has been appointed by the provincial government to head a commission of inquiry into the disaster. A resolution has been forwarded to G. H. Ferguson, Premier of Ontario, by the miners of Timmins, asking for representation on the commission.

Full shifts are now at work in the mine, which has been completely cleared of all traces of gas and smoke. Hollinger officials have announced that full pay will be given to all employees for the time during which operations were suspended. At the same time, compensation to the families of the victims has been arranged.

Two Miners Plunge to Death in Arizona Cage

A cage containing eight men crashed 20 ft. into the water at the bottom of the Edith shaft of the United Verde Extension, Jerome, Ariz., on Feb. 15. Two of the men, becoming panic-stricken, jumped just at the time the cage hit the water. Their bodies were caught between the cage and the timbers, and the men were crushed to death. The other men were unhurt. Both of the dead were Mexicans, Refugio Real and Luz Castillo.



Mine rescue car No. 3, completed early in 1928, at siding near power plant of Pittsburgh Experiment Station of U. S. Bureau of Mines

Mine Rescue Car Makes Record Trip From Pittsburgh to Timmins

By Paul Wooton
Special Washington Correspondent

CAR NO. 3, attached to the Pittsburgh station of the U. S. Bureau of Mines, left that city at 9:15 a.m., Feb. 11, and arrived at Timmins, Ont., at 6 a.m., Feb. 12, performing a regular 42-hour trip in just half that time. It was sent in an attempt to render a humanitarian service to a sister nation. Fifty-one men were trapped by fire in the Hollinger mine, and suitable equipment to save them was not at hand. Several attempts to enter the mine had demonstrated, beyond all doubt, that it would be impossible to effect rescues or control fire without that equipment.

Scott Turner, director of the Bureau of Mines, was informed of the situation on the evening of Feb. 10 by A. F. Brigham, general manager of the Hollinger. Mr. Turner immediately ordered mine rescue car No. 3, then at Jenners, Pa., to proceed to Pittsburgh at once to take on additional apparatus and a mine rescue crew, headed by Daniel Harrington, chief engineer of the Bureau's safety division; George McCaa, a former All-American half back and one of the Bureau's most experienced mine rescue men; S. H. Katz, specialist in the use of oxygen helmets and gas masks; Russell Thornburg, another experienced mine rescue man; and Joseph Ferraro, a first-aid miner.

In the meantime, Frank C. Gregory, district engineer at Duluth, and A. J. Martinson, a foreman miner at Duluth, were instructed to proceed to Timmins.

The car was fully supplied with surplus equipment so as to be able to cope with any emergency that might arise. Drawn by a special locomotive, it left Pittsburgh at 9:15 a.m., Feb. 11, and was given right of way over all trains to Buffalo. Similar preference was given it over the Toronto, Hamilton & Buffalo to Toronto; over the Canadian National Railway to North Bay, and over the Temiskaming & Northern Ontario Railroad to Timmins, where it arrived shortly after 6 a.m. on Feb. 12.

On account of the international features of this disaster, and since a mine rescue car never before had been sent beyond the confines of the United States, the spectacular dash of car No. 3 aroused great interest in official circles in Washington. There is general satisfaction that such a creditable showing was made and that the United States was in a position to extend much-needed aid in the emergency which overtook America's largest gold mine.

A crew on car No. 3 fully equipped for rescue and recovery work—Two-hour oxygen-breathing apparatus, electric cap lamps, self-rescuer, and flashlight, all of permissible types approved by the U. S. Bureau of Mines.

Interior view of part of car No. 3. Oxygen bottles at left. Apparatus is kept in lockers. The work bench is for assembling and examining apparatus

Though the trip was in vain as far as saving of life goes, the rescue team rendered effective service in locating the fire and in the recovery of the bodies of the men. They were able to get water to the fire, and soon had it under control.

Car No. 3 is one of the new mine rescue cars allowed by Congress last year to replace a car that had been in use for forty years. The aid could not have been extended if there had not been available a car capable of withstanding high speeds and hard usage.

Left—The Tajo shaft at La Bessie Way mine. Right—A mineralized quartz rhyolite outcrop on the property

Important Development Completed at La Bessie Way Mine

IMPORTANT development, resulting in the blocking out of ore discovered during the previous year, has been completed at the La Bessie Way mine, 16 miles east of Alamos, Sonora, Mexico. A total of 400 ft. of work revealed good showings in several crosscuts and minor drifts, besides excellent results in driving the upper crosscut tunnel which cut the vein 16 ft. below the bottom of the Tajo shaft. In advancing the lower tunnel to a point 400 ft. from its portal, good ore was also encountered. The upper workings indicate a stoping ground 40 ft. long averaging 13 ft. in width. In the lower tunnel the face shows a continuation of high-grade galena, assaying better in both gold and silver than that in any other section of the mine. The face of the lower tunnel and drift from the crosscut, 200 ft. above, are both being driven south into what is considered to be the best portion of the mine, as the outcrop and exploration show it to be the widest and most uniformly mineralized.

The section north, or about 450 ft. along the vein, has been well proved to depths varying from 100 to 250 ft. Samples taken across several important openings, averaging 75 ft. in depth, gave good assay values. The lower tunnel has been run on the hanging-wall vein, which is fairly soft and iron-stained. The galena vein in the foot-wall side is a hard quartz vein which breaks well. Crosscuts from the hanging-wall vein are being driven to open up the galena vein. Important showings of high-grade galena are also exposed in the lower tunnel, but no general samplings nor conclusions will be possible until the work is carried further and more crosscuts are made. There is now enough ore broken and developed on the property to keep a 50-ton mill in active operation for several years.

Treadwell Yukon to Erect Mill at Tybo, Nev.

EXPLORATION and development of the Tybo, Nev., property of Treadwell Yukon has resulted favorably, and it has been decided to proceed with the erection of a 200-ton flotation plant. The property is in the Hot Creek district of Nevada, northeast of Tonopah. The district was discovered in 1865. In 1868, two 10-stamp mills were in operation. The Tybo section was discovered in 1870 and a smelter erected in 1874. The Tybo company built a furnace in 1875 and erected a 20-stamp mill. At the time lead and silver, with some gold, were the metals produced.

The district was inactive until Louisiana Consolidated Mining began operations in 1917 by building a 75-ton concentrating mill. In 1919 a flotation plant was erected, and this was followed by a small lead smelter, both of which were operated upon a limited scale, and some bullion produced. The enterprise failed. Morey Mining was organized in 1922 to protect the interests of some of the investors and title was acquired. Treadwell-Yukon took over the property on Oct. 19, 1925. The power line, which had been dismantled, was reconstructed. Extension of the shaft from the 400 level to the 700 level followed, and drifts were driven both east and west, a total distance of 2,000 ft. The result of this development was to expose more or less continuous ore along the entire drift length, and a greater width than had been exposed upon the upper levels. At the extreme east end an ore width of about 100 ft. was crosscut. The ore approximates 8 per cent lead, 6½ per cent zinc, 13 oz. of silver, and 0.02 oz. of gold per ton.

The mill, which is to be designed by Lloyd C. White, will have tbe following features: crushing to four inches in jaw crusher, washing, and screening, Undersize will go to mill feed and oversize to a sorting belt, waste rock being rejected and remainder going to a cone crusher. Undersize and cone crusher products are to be reduced in ball mills and then sent to flotation. Lead and zinc concentrates are to be made, hauled to Tonopah, and shipped to smelters.

It is also planned to construct a new shaft by raising to the surface from the mine levels. A new level, 150 ft. below the 700, is to be opened up. A new mine plant, hoist, compressor, and shops are to be constructed in close proximity to the new shaft and mill. An adit will connect the shops to the shaft. Living quarters are also to be constructed. At present 40 men are employed. W. H. Blackburn is general manager and W. E. Hale is superintendent. Hauling is done under contract from Tonopah, which is the nearest rail head to the property.

California Copper Property to Be Reopened

R. L. HUSSEY, who recently acquired the sole ownership of the Greenhorn property, plans to start immediate operation. The Greenhorn is a copper prospect, formerly owned by Atascadero Mining. Mr. Hussey bought it at the bankrupt sale of the company. The tonnage already blocked out is said to be large. A small milling plant, probably consisting of two 50-ton units, will be constructed. Greenhorn is on Willow Creek, northwest of Redding, Calif.

A small custom mill is being erected at the New England mine, in Washington district, Nevada County. A cyanide plant will be operated with the mill.

Tacoma Mining has completed a 2,500-ft. pipe line at its hydraulic mine in Mariposa County. The property is known as the Prouty.

Operations Start at 100-Ton Mill in Wyoming

Wyoming Platinum & Gold has just started its new 100-ton mill at Centennial, Wyo. The ore is platinum-gold with an estimated recovery of $25 a ton. As this is by far the largest undertaking of its kind in the state, it is being watched with interest by mining men. Success for the mill would give the state industry a wonderful impetus, but it is probable that adjustments, both in machinery and in treatment methods, will be necessary before extraction profits reach maximum.

Several Buildings at Premier Mine Destroyed in Fire

A FIRE that originated in the cookhouse at the Premier mine, in British Columbia, destroyed the bunkhouse, community hall, company store, post office and all mail therein, and Kella's store and pool room. Fortunately, the working buildings, the apartment house for the staff, and the manager's residence were not harmed. The damage is fully covered by insurance. In fact, the company carries a policy that would cover the income lost through idleness had the working buildings been burned. But for the splendid work of the Premier company's own men and men from the surrounding mines and the settlements of Stewart and Hyder, all of the buildings would have been destroyed.

B. C. Silver Mines, which has had only a small force of men at work during the negotiations with the Premier company for the latter to take over the development of the former's mine, has placed its unused accommodations at the service of the Premier. B. C. Silver has two bunkhouses, which together will comfortably accommodate about 100 men; many more can be crowded into them temporarily. Premier employs about 400 men. Dale L. Pitt, general manager for the Premier, was at Victoria at the time of the fire, in connection with the taking over of control of the Silverado group, so he was able to see to the hastening of emergency supplies to the mine to take care of the men.

The loss is estimated at between $100,000 and $200,000. Replacement of the buildings will begin as soon as possible. Present conditions are favorable for freighting supplies, as there is a good bed of snow on the road, but they are unfavorable for building operations. Mining and milling are being continued at normal rates.

B. C. Silver Mines has declined the Premier company's offer to operate its mine and mill the ore at a cost-plus rate per ton. It has started to sink a 400-ft. winze from its No. 4 level.

Surface plant at the Premier mine

Salmon River Properties Change Owners

LOS ANGELES interests have acquired an option on the Cantu group, on Salmon River, Alaska, and propose extensive development. Two years ago Premier Gold Mining did considerable diamond drilling and other work on the property, on which it had also made a substantial cash payment, but results were disappointing and the option was abandoned.

On Prince of Wales island, the Kassan Gold Co. has been running the mine and mill only one shift a day, owing to shortage of power. W. J. Elmendorff, the company's consulting engineer, states that an additional 100-hp. semi-Diesel engine and compressor are being installed with a view to full operation of mine and mill. The latter will also be increased from a capacity of 60 tons a day to 120 tons. The mine is developing well with depth, the oreshoots attaining a width of 8 ft. It is proposed to deepen the shaft and open No. 5 level. Concentrates are reported to show a recovery of 85 per cent.

Prospectors are already on the move for the big river discovered last summer by S. R. Capps, of the U. S. Geological Survey. An airplane party from Anchorage has already made a superficial survey of the country tributary to Lake Chackachamna, where the river takes its rise, and reports much iron-stained country which is considered worth prospecting. The field can be reached in a little over an hour from Anchorage by airplane. At Valdez active development is going on at the Seeley-Davis mine.

Fairbanks Exploration is making good progress in equipping the Goldstream and Chatanika dredges, and it is probable they will be ready for operation on schedule time. L. Rogge has taken an option on 7 miles of new dredging ground on Rex Creek, with a view to drilling it and ascertaining its prospective value. T. King and H. Johnson, of Fairbanks, have acquired all interests in Chatham Gold Dredging, which has been operating successfully on Chatham Creek for the last four years. The company's gravel reserves are sufficient to maintain operations for another eight years.

Xanthate Used in Flotation Before Perkins Patent

JUDGE BOURQUIN, of the federal court, decided in favor of the defendant in the suit of Metals Recovery vs. Anaconda Copper, recently held at Helena, Mont., as stated in last week's *Engineering and Mining Journal*. The judge held that the Perkins flotation patent, under which plaintiffs brought suit, falls short of the statutory requirements. Even if the claims were valid, there would be no infringement, as "xanthate," a flotation reagent, now used by all the larger mining companies, was in use before the Perkins patent was granted or applied for. Anaconda's counsel claimed that the alleged patent was too broad and general in its claims to be valid, and even if it were valid the reagents used by Anaconda in flotation did not infringe upon it.

Diamond Drilling Progresses at Amulet

FOUR diamond drills are operating at the Amulet property, in Rouyn, Quebec. Most of the work is being done in the No. 4 area, where high-grade zinc has been encountered, south of the fault. A good-sized body of zinc has already been proven, and the dimensions are being enlarged as the drilling progresses. A 10-drill compressor has been ordered for the No. 4 shaft, which is to be enlarged and made the center of underground operations. Plans for the building of a railroad branch into the property and for addition to the surface works are being made.

Crosscutting at the Granada, in the same district, has disclosed some highly mineralized quartz. Samples of these indicate the presence of free gold. This is the best showing yet encountered at the property. The discovery was made on the 125 level. R. C. Gamble, president of the Granada, expects to have the new electric plant, now being constructed, in operation by the end of March. The additional power will enable development at the deeper levels, notably the 1,000 level. Crosscuts will be driven, it is stated, every 150 ft. of depth.

The Stabell property, at Harricanaw, near Rouyn, is being reopened by J. E. Hammell. It was first developed in 1924-25, when a shaft was sunk to the 600 level. Development at the time was not sufficient to demonstrate the possibilities of the property, although fair mineralization was found on the 300 level.

Mexico City Letter

By W. L. Vail
Special Correspondent

Lack of Shutdowns Indicates Notable Stabilization in Mexican Mining

Mexico City, Feb. 7, 1928—For several weeks no application has been made by a mining company in Mexico for permission to shut down. This is taken as a sign that companies now operating have adjusted themselves to the abnormal conditions created by the low prices of lead, zinc, and copper. Until the middle of December, it was customary to see a few applications for suspension filed each week. Recently, however, companies have preferred to attempt improvements in management and practice rather than shut down completely. The department in charge of mining affairs has encouraged this, as it affords a solution for the labor problem. In fact, it is doubtful if there has been any time since 1910 when the relations of labor and capital have been so amicable. The larger unions are engaged in ridding themselves of undesirable elements, principally foreign agitators, and have little time to devote to the owners. The existing period of low prices also tends to make labor more tractable in its demands on the owners and operators.

A mill and power plant will be erected on the Promontorio claims, in Durango, by American interests. In the meantime the mine is shipping high-grade ore to Torreon.

RESUMPTION of activities at Montecarlo, in Guerrero, has been made possible by the evacuation of the bandits who formerly infested the neighborhood. Concentrates will be shipped monthly to the Monterey smelters from the 100-ton mill. Another mill in the same district, that at Xitinga, is producing four tons of concentrates daily. Operation of a cyanide unit should begin in May. At Taxco, the Atlixtac mill of International Ore & Smelting will resume operations after being closed down for remodeling. Development work at the mine has been progressing favorably, a new vein of ore having been encountered. A number of requests for quicksilver concessions have been made recently in the Taxco district.

Jalisco reports would indicate that that state's mining industry is back to almost normal production. Machinery for the new concentrating plant at the San Fernando mine has arrived, and operations should be started by the middle of April. Cinco Minas is working full time and the Bradbury interests are pushing development work at Bolanos. Some concessions have been granted along the Southern Pacific railway line, but little development has been done.

The old San Fernando mine, a well-known silver-lead-zinc property of other days, in the Rio Dulce section of Oaxaca, has definitely suspended operations. This property was taken over by H. W. Catlin, of New York, about 1924, and according to reports, approximately $100,000 has been spent in development work. One of the drawbacks aside from the prevailing low prices of metals is the lack of near-by transportation.

New York interests have acquired the San Miguel properties, near Zacualpan, State of Mexico. The workings are being cleaned out in readiness for an active development campaign. Sultepec, an old mining camp, is planning a revival. Construction of an automobile road to the district is being pushed. About 200 men are employed on the work, which should assure transportation at two-thirds former cost from Sultepec to San Juan de las Huertas.

Johannesburg Letter

By John Watson
Special Correspondent

Diamond Rush at Grasfontein May Be Last Held in Transvaal

Johannesburg, Jan. 13, 1928.—A diamond rush took place on Jan. 6 at the Grasfontein farm. This may be the last of the rushes for which South Africa has long been famous, as the new Precious Stones Act, recently passed by the Union, provides for a system of drawing lots for the choicer claims. Signal was given by F. J. Mathews, Acting Commissioner of Mines. About 4,000 runners took part in the rush. There was one fatality, a youth dying of heart failure. The rush is not expected to have any adverse effect on the price of diamonds, as the ground is poor and output will probably be small.

At the annual meeting of Potgietersrust Platinum, held in Johannesburg recently, the chairman, J. H. Crosby, gave the results of treatment of 110 tons of concentrates. He reported an extraction of 75 per cent of the precious metals, and 90 per cent of the nickel and copper. The total value of the metals in the entire tonnage amounted to £7,196. Cost of experimentation was £3,882, leaving a balance of £3,314. Mond Nickel treated the concentrates.

PREPARATIONS for the second Transvaal Industrial Exposition are well advanced. The Exposition will be held in Johannesburg from Feb. 21 to 25. One of the most interesting exhibits should be that of the Chamber of Mines. This exhibit will occupy the entire platform of the Town Hall and will represent in miniature the many-sided work of a gold mine.

London Letter

By W. A. Doman
Special Correspondent

Rhodesian Mining Industry Summarized by P. K. Horner

London, Feb. 7, 1928.—Rhodesia, as a mining—or speculative—field is still very much to the fore. Last year P. K. Horner, consulting engineer for Minerals Separation, was commissioned to visit and report upon various mineral areas, and the recommendations made by him are now being acted upon. Minerals Separation are the general managers of Southern Rhodesia Base Metals, and Mr. Horner's suggestions for drilling in the sulphide zone and the investigation of the treatment of the oxide and sulphide ores at the Alaska mine are to be put into practice. In the meantime, as already reported, work has been curtailed at the Copper King and Copper Queen properties. Mr. Horner says that electrical prospecting in the ore area investigated near the Copper Queen has given highly satisfactory results. There are seventeen orebodies, seven of which outcrop. The manager says he is satisfied that the outline of the sulphide orebodies can be determined with a fair degree of accuracy by the electrical method. Sufficient oxide ore is developed at the Alaska mine to warrant the board in considering the possibility of treating this ore on a basis of up to 250 tons daily.

APPARENTLY neither the directors of tin-mining companies nor the shareholders thereof know what to make of the present position. One week the price of the metal advances, and the next it recedes, and both the party desiring stabilization and the party opposed to it cling to their views. At the time of writing the quotation is £242 13s. 9d., the lowest level touched for some months. So far as can be gathered, the Malayan producers take the matter philosophically, and are still earning substantial profits. Costs being higher in Nigeria, producers there are not regarding the position quite so light-heartedly. As a result, the share market is quiet—not to say depressed in parts—though occasionally some specialty is pushed up for its effect on organization and financial sentiment.

In the course of a conversation with those who should know, the question of Wiluna Gold (Western Australia) was discussed. All admit that this is a great deposit, but some doubts are expressed as to whether sufficient allowance has been made for working costs, even with the government railway assistance, and for the demands that are likely to be made for and by labor. It is all a matter of opinion.

Annual New York Meeting of the A. I. M. E. Attracts Record Attendance

Good Program, Mild Weather, and Hoover, Instrumental in Attracting Large Body of Out-of-town Mining Engineers

THE ANNUAL MEETING of the American Institute of Mining and Metallurgical Engineers held Feb. 20 to 23, was even more successful than those that have gone before. Certainly, the attendance was all that could be desired—over 1,400—the technical programs were attractive, the sessions in general well managed, the weather much better than usual, with none of the customary slush, and the social features reached a happy culmination in the presence at the banquet table of Herbert C. Hoover, who made an address that was probably heard by millions throughout North America. More than the usual number of mining engineers from distant points were apparently on hand, the quota for the validation of railroad certificates being reached early in the meeting.

No doubt Mr. Hoover's presence, coming so soon after the launching of his political campaign for President of the United States, was the chief magnet for many. The dinner committee was swamped with over 1,100 applications for tickets whereas only about 800 had been expected; however, all were taken care of that were received a reasonable time before the dinner began, and the diners were rewarded with not only an interesting address by Mr. Hoover, but with commendably short and effective speeches by the others who addressed the gathering. Credit for this state of affairs is perhaps due to the fact that WJZ and many other stations stretching to the Coast devoted the hour between 9 and 10 to broadcasting the banquet, necessitating a strict adherence to a time table in serving the meal and in presenting the speakers. The result was most happy, and it was not long after 10 o'clock when the new president of the Institute, George Otis Smith, wound up the proceedings with the remark that the affair was now history, leaving the floor to the more light-footed members, who performed valiantly until 2 a.m.

C. J. Kelley's Introductory Address

Mr. Kelley introduced Mr. Hoover, saying, in part:

"Mr. Toastmaster, Distinguished Medallists, Ladies and Gentlemen: It is no new experience for the distinguished subject of this presentation to be the recipient of honors conferred, to be eulogized for successful accomplishment, or to hear expressed with sincerity the admiration of his fellows. The objectives of his professional endeavor have taken him to many fields; the scenes of his labor have varied from the most remote corners of the globe to those which are close at hand; the universality of his experience is an epitome of modern life, impossible of occurrence in any other era. His career not only embodies to an unrivaled degree the opportunities of the contemporaneous epoch, but exemplifies in the manner in which they have been interpolated into successful accomplishments the possibilities of our age.

"The many-sided career of our medallist is a composite. Tonight we deal chiefly with its phase for which this medal has been bestowed. The Saunders medal has been conferred by the American Institute of Mining and Metallurgical Engineers on Herbert Hoover in recognition of his distinguished contribution to the progress of mining engineering. It may be, therefore, superfluous to say that had his career been attended by no greater achievement than that of its professional attainment, the honor would have been worthily won; and, conversely, no matter what other garlands fame might have brought, without its having been professionally deserved in the judgment of his fellow engineers, it could not have been bestowed.

"No engineering body can honor you for what you have done in your profession without an appreciation that they are likewise recording the honor which you have brought to it and to its members. No medal can fail to recognize the manhood displayed by you in the assistance rendered to humanity, or omit to note the lustre that has hallowed your citizenship in the service of your country."

Mr. Hoover Responds

Responding to Mr. Kelley's introduction, Mr. Hoover spoke as follows:

"No one could fail to be gratified to receive so profound an approbation in his calling from the members of one's own profession. To have received this distinction from men, many of whom have been professional associates and friends over more than a quarter of a century, warrants a pride and satisfaction that could come from no other source. It has often been said that men are really known only to their brothers in labor and in profession.

"The long friendship I have received from Mr. Saunders and the distinguished service that he has contributed to the mining industry add to my appreciation of this event. Mr. Kelley's remarks bring my mind easily to the beginning of that period of great advance in the engineering profession of 40 years ago. Three great forces contributed to the development of the profession. The first was the era of intense development of minerals, metallurgy, and transportation in our great West. It greatly stimulated invention; it made a demand for training and skill on the part of our engineers. The pressure of national development advanced our American practice beyond the rest of the world. Moreover, the skill of our engineers of that period owes a great debt to American educators. The leaders of our universities were the first of all the educators of the world to recognize that upon them rested the responsibility to provide fundamental training in the application of science to engineering under the broadening influence and cultivation of university life. They were the first to realize that engineering must be transformed into a profession in the highest sense, not only in the training and character, but that the essential quality of a profession is the instillation of ethics. That implies not alone the job but the responsibility of the community for the job. Our universities poured into our development a great stream of men with this background and training. A third distinction that grew in American engineering was the transformation from solely a technical profession to a profession of administrators—the business manager with technical training.

"Our American engineering practice in many branches, particularly in mines, transportation, and electricity, became the envy and ideal of the world. American engineers were solicited to install American methods and American machinery abroad. The first of these demands came from South Africa, for such men as Hamilton Smith, Hennen and Sydney Jennings, and John Hays Hammond. Quickly their brilliant success created a demand for more and more of their kind, followed by hundreds of others. Your expressions are at least idealization of that whole caravan of American engineering missionaries. Perhaps few of us realize the effect of their service both at home and abroad. A vast sum of industrial advance over the whole world came from their hands. A vast amount of added experience was brought back to our country. A vast support was given to our manufacturers and workers in the export of American equipment. There grew up a vast appreciation of America as a land of intellectual as well as material accomplishment.

The Salary Question

"The reputed salaries and high commands of these great men in our professions fired the imaginations of the college youngsters of my day. When we

left college and offered our intellectual wares, however, to the hard-fisted mine managers, we had great disillusionments. We went further into the depths when we moderated our offerings step by step from a willingness to favor them in the position of assistant manager, down finally to a job pushing a car and pounding a drill in the wettest level. In any event, on the night shift we youngsters had a certain amount of time to think how much easier it was to be a consulting engineer or manager of great enterprises at a high salary than to push a car at $2 a day. I was sure at that time that the manager of the mine where I worked had so little a quality of insight into my true value that at least he would never merit being called into anything higher. I was even disposed at that time to think he was destined for something even lower. But in fact in after years I was grateful for this apprenticeship, and indeed it is this rigorous insistence on the part of our elder engineers which has contributed much to our American training. In time came the opportunities from the great leaders of American engineering at home and over the world for crews of university trained youngsters. One of these jobs came near our town. There was no fantastic salary attached to it, but we had difficulty in refraining from offering to take it for less for fear it might escape.

Not All Romance

"The first real important job is the momentous thing in an engineer's life. Each of us in turn has believed that all hope for the future and the present fate of whole nations depended upon its proper accomplishment. And these first jobs are never arm-chair labors. They do not take place in the comfort of cities. Living on the edges of civilization is a much more drab affair than the current novels on frontier life would lead one to surmise. Yet there endures to the layman something of romance and adventure in the engineering profession. Kipling, Richard Harding Davis, and others have given high color to the romance of our profession. My own experience with the romance of it has made me wary at times of the romance parts. When I hear of it I have a desire also to know how long ago it took place. I have learned that the romance factor increases with time. My experience in the adventure parts of the engineering profession is even more dubious—anything of this sort from bad men to armies, wars, shipwrecks or floods which come across the engineer's orbit, are disturbers of progress. They interrupt the job. They all require repairs afterward; and no engineer gets satisfaction from repair jobs. But, after all, it is an occupation of enormous diversity of interest, a change of scene, of vivid and human relations. There is but little of repetition. It is a constant call for all that lies in men.

"The exchange of engineering experience and scientific discovery between nations is one form of internationalism that is beyond any reservations. America has made notable contributions to this advancement. Our metallurgy, our underground engineering, our many inventions for the saving of labor in every industry—our revolution in communications, and in scores of other directions—have been but part of our contribution to the common pool of human knowledge. And we have received more than we have given.

"We inherited a great store of knowledge from our European forebears and in many branches we have been at times the importers of foreign engineers. One of the responsibilities of American engineering is to profit by every advance in every country, bringing its fruits to our own people. And I may add a word upon these responsibilities generally. The job of the engineer is the application of science to the increased comfort and safety of man. It is his work to take from the laboratory of the scientist the raw material of thought and discovery and to materialize it into daily use. He, therefore, has a responsibility not alone to keep his application of science abreast of science and of discovery, but, on the other hand, he must assure that support be given scientific research; for without new discovery the progress of engineering must cease.

The Wider Field for the Engineer

"Engineers have made magnificent contributions to progress. The gradually decreasing hours of labor, of greater stability of employment, of lessening sweat and drudgery from men, the widening comforts of life, the increased standards of living, the enlarged vision and opportunity to the individual, the stimulation to initiative and invention, are to no small degree the product of the engineering pro-

HERBERT HOOVER

fession. And the engineers have come into a wider responsibility than solely the application of their technology—more and more the engineers themselves are the actual administrators of great industry. To them comes more and more the human problem of relations between employer and employee, the relations between producer and consumer. The mind trained to regard the consequences of action in their human results bids fair to be the largest of the contributions of the profession to progress.

"As our population grows in numbers, as our problems become more complex, so does also grow the need for wider and wider vision of the engineering profession. Our problems of transportation, of housing, of power, of communication, of economical use of our natural resources, of safety and protection to our people, now require long planning in advance. We no longer have a right to think in terms of our own generation. A greater America for our children will in large degree depend upon the engineering profession."

S. G. Blaylock Introduced by Mr. Turner

Scott Turner, Director of the U. S. Bureau of Mines, then introduced S. G. Blaylock. He said in part:

"Mr. Blaylock is a Canadian by birth, training, experience, and preference. His outstanding achievements have been the acquisition for his company of the Sullivan mine and the organization of a metallurgical staff, which solved the difficult problems presented by the extraordinary complex lead-zinc-silver ores of the Sullivan mine. By title only, I will suggest to you the high lights of his career: (1) Development of the great mine at Kimberley and the huge plant at Trail. (2) Discovery and application of a successful differential flotation process for Sullivan ore which had previously not responded to any process. (3) Improvements in lead-blast-furnace and refinery practice. (4) Development of an electrolytic process for treatment of zinc concentrates. (5) Development of an electric-furnace-smelting-method for zinc-plant residues."

Mr. Blaylock, acknowledging Mr. Turner's tribute, said:

"Mr. President, Mr. Turner, Members of the Institute, Ladies and Gentlemen: I was never more surprised nor more pleased in all my life than I was when I heard that I was to receive the James Douglas Medal. There were so many pleasant sensations connected with the receipt of this notification that it would be impossible to name them all. I would, however, like to mention a few.

"The first was an overwhelming sense of pride that our American Cousins considered our efforts worthy of the most coveted metallurgical distinction in the world—the James Douglas Medal—the American Hallmark of Non-ferrous Metallurgy. The next was a fleeting memory of Dr. Douglas himself receiving his Doctor's Degree from McGill University at the same convocation that I received my Bachelor's Degree. His quiet strength and dignity made a lasting impression on me. Then came a friendly feeling toward Americans generally, and appreciation of their generosity and broad-mindedness in awarding this medal to a Canadian for work done in Canada on Canadian ores. This was followed by humility. I realized that this award was not earned by any one man, but by the combined efforts of the most loyal organization that any man was ever fortunate enough to have. What would these men think of my receiving the honor for the work so largely done by them. Perhaps the greatest sensation of all was finding out that these men knew all about it and had done all in their power to further my selection.

"I have received hundreds of messages of congratulation from all over the Dominion of Canada from individuals in every profession, from engineering societies, universities, boards of trade and government officials. The keynote of every one of these messages was gratification and keen appreciation of the friendly and generous action of the American Institute of Mining and Metallurgical Engineers in paying this great compliment to Canadian engineering."

Acceptance of the Hunt Medal

John A. Mathews, in accepting the Hunt Medal, said:

"For some twenty-five years I have had more or less to do with various medals and awards of the American Chemical Society, for the Howe medal of the American Society of Steel Treating, and in recent years the Johnson and Hunt awards of this Institute. I have often wondered how those fellows felt who were singled out for special honors and recognition. Now I know; it is a very agreeable sensation and I thank you."

Numerous committee luncheons and dinners gave the opportunity of more intimate discussion of specialized matters than was possible at the open sessions; most of these were held at the Engineers' Club. Next to the annual banquet on Tuesday night, the smoker held at Mecca Temple on the first night of the meeting was the principal social event of the convention. This gave an opportunity for much informal gossip even if the entertainment left something to be desired. They do these things better at the Canadian Institute meetings but here, of course, there is a legal stumbling block.

Many of the fairer sex were registered and the usual teas, luncheons, and trips to points of interest were provided, so that the time was fully occupied. A theater party to see "Interference" was arranged for Monday night. Mrs. Herbert C. Hoover was elected to head the Woman's Auxiliary.

Excursion Attracts Many

On Thursday morning 130 excursionists in four comfortable de luxe buses left Institute headquarters for an all-day-trip to the Perth Amboy plant of the American Smelting & Refining Company, with a stop-off at the Holland vehicular tunnels under the Hudson River. A group of engineers on the staff of Ole Singstad, chief engineer for the tunnel commission, and himself a member of the Institute, escorted the visitors through the New York "Land" ventilation building, explaining the equipment and intricate system of control of the world's greatest ventilating installation. The buses then traveled through the tunnel, giving the members an opportunity of seeing the results of the operation of the equipment they had seen.

DR. GEORGE OTIS SMITH
New president of the A.I.M.E.

Commodore Is Engineers' Favorite Hotel

THOUGH there are hundreds of hotels in New York City, the choice of visiting mining engineers seems limited largely to a group of four—the Commodore, Waldorf, McAlpin, and Pennsylvania, in the order named. At least this is what the registrations of the visiting members of the A.I.M.E. at the convention indicate. The Waldorf was no doubt selected by some because it was the scene of the annual banquet. The Commodore is adjacent to the Grand Central station, and the Pennsylvania to the Pennsylvania station.

The most popular hotels, with the number of engineers reporting as registered at each during the meeting, follow:

Commodore	86
Waldorf	72
McAlpin	53
Pennsylvania	51
Roosevelt	18
Belmont	17
Vanderbilt	13
Manger	11
Prince George	11

At Perth Amboy an excellent lunch was served in one of the company's cafeterias to fortify the visitors for the trip around the big plant. A. E. Hall, manager of the plant, and his assistant, George J. Gordon, acted as hosts in behalf of William H. Peirce, who could not be present.

The technical sessions were numerous and taxed the capacity of the various directors' and committee rooms of the Engineering Building at 29 West 39th St. Many subjects were covered which were not of immediate interest to most of our readers, so the discussion will not be reviewed here. These included topics of interest to those engaged in work with iron and steel, coal and coal products, petroleum, and the Institute of Metals. The session devoted to milling methods will be reviewed in these columns next week.

Geophysical Prospecting

Geophysical methods of prospecting had a prominent place on the program. The prevailing interest in the subject was reflected in the large audiences attracted. E. L. De Golyer, president of the Institute and, incidentally, of the Geophysical Research Corporation, presided at the opening session, Monday morning. Gravity methods only were considered at this session.

The first speaker, Donald C. Barton, of Houston, Tex., presented a paper on "The Eötvös Torsion Balance, Method of Mapping Geologic Structures." In it he discussed the theory of the balance, the factors determined by it and their interpretation, as well as the limitations and possibilities of the instrument. He presented and interpreted data obtained in Texas and Oklahoma correlating them either with the results obtained subsequently by drilling or with already known facts as to local subsurface geology.

H. Shaw, of London, next on the program, was not present. His paper, entitled "Gravity Surveying in Great Britain," was presented by title by the chair.

Analysis of the mathematics of the computation of Eötvös gravity effects was given in a paper by E. Lancaster-Jones, of London, which also was presented by the title only.

A third paper to be presented by title was that of Dr. C. A. Heiland, professor of geophysics at the Colorado School of Mines. His subject was "A Cartographic Correction for the Eötvös Torsion Balance." The correction suggested by Eötvös was cumbersome in application in some instances, according to Dr. Heiland. The substitute method described in the paper has been employed for about two years by certain oil companies in the United States which are using this balance in their exploration work.

Results of four experiments with the Eötvös balance in the Tri-State zinc and lead district were described in a paper by P. W. George, Baxter Springs, Kan., which was read by Prof. D. H. McLaughlin, of Harvard. These results indicated that the balance would be useful in the district only under favorable conditions and for outlining the silicified and fractured areas previous to drilling. Among the conditions considered especially favorable by the author for use of the balance previous to drilling are those under which a comparatively small number of balance observations may distinguish the silicified zones associated with zinc ore from those of unaltered limestone.

Thirteen Foreign Countries Represented at Convention

Sometimes in the past the annual convention of the A.I.M.E. has seemed largely a local affair, with only a smattering of guests from distant points. Not so this one, however, for the home addresses cover thirteen foreign countries, considering Canada in that category for the moment, and a comparatively large number came from the Far West, though only two from Arizona. Those far from home included:

R. H. Allport, Billings, Mont.
Max W. Ball, Denver
Geo. B. Barbour, Peking, China
Robert N. Betts, Portland, Ore.
S. G. Blaylock, Trail, B. C.
Knud G. Bolander, Stockholm, Sweden
Mr. & Mrs. J. M. Boutwell, Salt Lake
Mr. & Mrs. Jess T. Boyd, Teziuplas, Mexico
A. E. Brugger, Brussels, Belgium
W. S. Buntine, Maria Elena, Chile
M. J. Callow, Salt Lake
M. F. Coolbaugh, Golden, Colo.
C. E. Vurbridge, El Paso
Mr. & Mrs. A. C. Daman, Denver
E. G. Deane, Globe, Ariz.
H. T. Dickinson, Johannesburg
C. L. Duer, Denver
B. W. Dyer, Salt Lake
Mr. & Mrs. J. O. Elton, Salt Lake
Mrs. Rudolf Emmel, Guayaquil, Ecuador
C. A. Fisher, Denver
G. L. Gillam, Los Angeles
Mr. & Mrs. A. S. Halley, Rapid City, S. D.
Mr. & Mrs. W. L. Heidenreich, Santa Monica, Calif.
E. A. Hersam, Berkeley, Calif.
Mrs. G. R. Hersam, Berkeley, Calif.
John Janney, Pioche, Nev.
Charles Janin, San Francisco
Henry Krumb, Salt Lake
W. Kupferburg, Johannesburg
Mrs. Elizabeth Labarthe, Berkeley, Calif.
J. D. Lampfield, San Helena, Calif.
Alexander Leggett, Butte
B. Lockwood, Stabley, Honduras
F. J. Maloit, Gilman, Colo.
D. B. McAllister, San Luis Potosi, Mexico
G. H. McDougall, Stellarton, N. S.
R. B. McGinnis, San Francisco
F. Cushing Moore, Spokane
N. E. Nilson, Copper Mountain, B. C.
D. O. Noel, Butte
R. L. Oertel, London
G. L. Oldright, Salt Lake
Mr. & Mrs. Robert C. Patterson, Taft, Calif.
J. R. Reeve, Billings, Mont.
Reno H. Sales, Butte
W. A. Schmidt, Los Angeles
B. D. Stewart, Juneau, Alaska
Mr. & Mrs. R. K. Stockwell, London
C. W. Stratford, San Francisco
R. E. Tally, Jerome, Ariz.
De Witt Van Evera, Provo, Utah
O. Barlow Willmarth, Georgetown, Colo.
A. B. Yates, Lead, S. D.
J. O. A. Carper, Denver
J. W. Finch, Denver
S. A. Ionides, Denver
J. Oparin, Russia
George Surabekoff, Baku, U.S.S.R.
N. O. Watson, Maracaibo, Venezuela
E. A. McKanna, Berkeley, Calif.
Mrs. Mark L. Requa, San Francisco
J. W. Williams, Buchans, Newfoundland

Cost of Geophysical Work

Sidney J. Jennings, in the general discussion following, raised the question of the relative cost of the seismographic and the gravitational methods. Dr. Barton replied that the cost to his company was $1,000 to $1,200 per month, using a single torsion balance and taking two stations per day. To take three or four stations daily would cost a little more. His company's standard rate for consultation work was $5,500 per month, four stations being taken per day. In mining work, as opposed to oil exploration, many readings were taken on a small area so that the cost might be a little lower.

The chairman, Mr. De Golyer, said the work was expensive, but that the question was whether it could be worth the expense. His company was dissatisfied if it failed to cover 200,000 acres per month in seismographic work. Sometimes as much as 40,000 acres was covered in a single day. The cost of 11c. per acre for seismographic work was given and 15c. per acre for torsion balance work.

The excellent work done with the seismograph in locating salt domes was shown by the figures that in the first three or four years of its use 30 new domes had been discovered, although discovery had been practically dormant for several years preceding.

Dr. Lee, of the Bureau of Mines, spoke briefly on the Bureau's geophysical program and asked for the cooperation of the industry.

Dr. Mason Takes Chair

Dr. Max Mason presided at the afternoon session. His now well-known paper on "Physical Exploration for Ores" was formally presented by title for record. Dr. L. B. Slichter, an associate of Dr. Mason's, presented an interesting paper entitled "Remarks on Magnetic Method of Surveying." In it he explained the peculiar importance of a few of the ferric minerals, especially magnesite, in classifying rocks magnetically. Experimental evidence showed, he said, that the susceptibility of magnetite changed greatly as the field strength was changed and that it also depended greatly upon the form in which the magnetite occurred. Hitherto accepted values appear far too low. He gave three instances of the fact that field observations of intensity often exceeded those which could be accounted for by aceepted values of the susceptibility. The higher values advocated appeared adequate to account for the observed results.

Dr. Warren Weaver, of Madison, Wis., discussed the mathematics of certain geophysical problems in a paper entitled "Certain Applications of the Surface Potential Method." He succeeded in making a difficult subject interesting.

Hans Lundberg then called attention of the audience to the salient points of his paper on "Recent Results in Electrical Prospecting for Ore." Practical results obtained in the field were sketched briefly, this possibly being more to the taste of many present than the exposition of theory.

The remaining papers on Monday's program—namely, "Earth Resistivity Measurements in the Lake Superior Copper Country," by W. J. Rooney, W. O. Hotchkiss, and James Fisher; "A New Micro-magnetometer," by Frank Rieber; "Working Method of Practical Geophysics," by Hans Haalck; "A Review of the Application of the Radiore Process in Canada," by K. P. Swensen; and "Some Applications of Potential Methods to Structural Studies," by E. G. Leonardon—were carried over until the following day.

Non-Metallics Arouse More Interest

For the first time since the establishment of the special committee on nonmetallic minerals, the number and scope of the papers presented was so great as to require two sessions. This is largely due to the efforts of Dr. Oliver Bowles, the chairman, and Arthur C. Avril, the secretary. At the opening session Monday morning W. M. Weigel presented a paper prepared by D. D. Dunkin which described the methods of exploiting sandstone in Arkansas for the preparation of raw material for making glass. One of the most interesting features was the description of a sand-grading device used as a substitute for a screen. The purpose is to remove fine material, most of which will pass through 80 mesh, and which composed only 5 per cent of the feed. Vibrating screens of various types proved unsatisfactory. The device developed and now in successful use consists of a continuous belt seven feet wide, the speed and slope of which can be varied. Sand at the rate of 12.5 tons per hour is fed onto the belt in a ribbon-like stream. On account of the difference in co-efficient of friction of particles of different size, the fine particles are carried to the top of the inclined belt, whereas the coarse slide and roll down the slope.

C. R. Forbes presented the paper "Geology and Mining of Diaspore and Flint Fireclays," written by himself and H. S. McQueen; and Charles H. Behre, Jr., his own paper on the development of the slate belt in eastern Pennsylvania. It appears that for the first time in history slate miners are taking advantage of systematic geological study in mapping out their scheme of exploitation.

At the Non-Metallic Minerals session, Monday afternoon, four papers were presented. Mr. Thoenen's paper on the "Genesis of Grecian Magnesite" was followed by a number of short discussions. The similarity of this deposit to the California deposits was noted. It was the consensus of opinion that the possibility of magnesite being of magmatic origin was not great.

G. F. Loughlin presented some notes on the value of petrographic analysis in the quarrying and use of stone, particularly stone and rock used in concrete aggregate.

G. R. Mansfield, of the U. S. Geological Survey, gave a brief exposition of the work the Survey has recently done in mapping the phosphate field of

SELWYN G. BLAYLOCK
General Manager Consolidated Mining & Smelting Company of Canada

southeastern Idaho. Maps of the section showing the areal geology in detail were displayed. A conservative estimate of the tonnage of high-grade phosphate rock available in this field alone is stated to be five million long tons.

Metal Mine Ventilation

In presenting the report of the subcommittee on Metal Mine Ventilation at the morning session of the Mine Ventilation meetings, at which George S. Rice presided, Daniel Harrington pointed out that during the last year a wealth of report data and discussion relating directly or indirectly to various phases of ventilation of metal mines had been published. Much of this information was from foreign sources. The phase of the subject most generously accorded the attention of the technical press was that of cooling mine air, with much less attention to other fairly intimately associated features, such as fan performance, friction factors, fires, mine gases, mine lighting, health of miners, and ventilation standards.

Reviewing the contributions on the subject of cooling mine air, Mr. Harrington criticised the recent tendency in South Africa to advocate methods which will hold air humidity to a minimum and to recommend the abandonment or at least the lessening of the use of water in drilling and in the watering of muck piles and face regions. This tendency was wrong, he said, and was not in accord with the country's efforts to combat silicosis among mine workers.

In the absence of Dr. R. R. Sayers, Mr. Harrington then presented the former's report on "Physiological Factors of Mine Ventilation." The report called attention particularly to the work of the clinic in the Tri-State district, which has now examined more than 10,000 miners.

Discussion of the papers "The Air-Current Regulator," by W. S. Weeks; "Propeller Fan Computation," by F. E. Brackett; and "Ventilation of the Liberty Tunnels," by L. W. Huber, occupied the remainder of the session.

Mining Methods

That the use of liquid oxygen as a blasting agent is now on a firm basis in the United States was brought out by George B. Holderer in his discussion of the paper "Liquid-Oxygen Blasting at Chuquicamata, Chile" by H. C. Schultz and F. K. Middleton Hunter at the morning session of the Mining Methods meeting which was devoted to explosives and at which Prof. R. M. Raymond presided. Mr. Holderer said considerable progress had recently been made in the application of L.O.X. at large strip mines and that during the current year two of the largest quarries in the country would be equipped with complete liquid oxygen manufacturing and storage units.

G. St. J. Perrott presented the papers "Relation Between the Oxygen Balance and Explosive Strength of Eight Gelatine Dynamites" by G. St. J. Perrott, N. A. Tolch, and J. E. Crawshaw, and "Effect of Oxygen Balance of Gelatin Dynamites on the Gaseous Products of Detonation" by G. W. Jones and G. St. J. Perrott. In reviewing the experiments mentioned in the papers Mr. Perrott pointed out that maximum propulsive strength of gelatin dynamites occurs in those having an oxygen balance of between —8 to —25 grams per 100 grams of explosive, and that all commercial gelatins are weaker when fired without the wrappers.

James E. Harding's paper "A Numerical Index of the Resistance Which Rocks Offer to the Penetration of a Drill Bit" was commented upon by B. F. Tillson and others, and the desirability of additional information on the subject was generally expressed.

At the afternoon session Harvey Mudd in presenting Roy W. Moore's paper "Mining Methods and Records at the United Eastern Mine" described it as being the life history of a small high-grade gold mine developed under favorable conditions, mined to exhaustion in 7½ years, and then closed down. Ultimate results were in close agreement with expectations, and profits were not dissipated in further exploration. Arthur Notman and Sidney J. Jennings commented on the value of the paper and commended the action of the United Eastern Mining Company in permitting the publication of the detailed information contained in the paper.

A suggestion that a symposium on the different variations of sub-level mining methods be held at the next annual meeting was expressed by B. F. Tillson in the course of discussion on B. Presley's paper "The Latouche System of Mining as Developed at the

Beatson Mine, Kennecott Copper Corporation, Latouche, Alaska."

"A Mining Company Balance Sheet" by George F. Wolff and "The Financial Report of a Mining Company—Its Content and Meaning" by H. B. Fernold were presented by the authors of the two papers for the Accounting Methods Committee.

A handbook containing a compilation of drilling and blasting data obtained from questionnaires sent to members of the mining profession by Theodore Marvin of *The Explosives Engineer* was distributed. Referring to the utility of the handbook Mr. Marvin called attention to the fact that, although dynamite continues to be what the operator often considers "the cheapest thing around the mine," complicated mining methods with their variety of stopes and chutes, mechanical loaders, and new types of ore-handling equipment have introduced intricate blasting problems. An animated discussion concerning the extent to which stemming is used then followed. Many of those present participated in the discussion.

Non-Ferrous Metallurgy

Only one session was devoted to non-ferrous metallurgy, this being scheduled for Wednesday afternoon. Two of the five papers were read in full, although printed copies were distributed, thereby curtailing the time available for discussion.

G. L. Oldright presented an abstract of his paper on "Suggested Improvements for Smelting Copper in the Reverberatory Furnace," written in collaboration with F. W. Schroeder. He explained the difficulties of publishing an original contribution of value in the light of the Carson litigation. Some interesting discussion followed, in which the importance of having roof arches that would withstand even higher heats than are now reached was emphasized. Some are experimenting with thick arches, say 30 in., but it was pointed out that a better idea is to develop a more heat resistant refractory, or to cool those now used, and use the pre-heated air thus gained in increasing the heat economy of the furnace. At United Verde, for instance, it was said that a double roof arch is being tried, with air cooling between the two layers, the air thus warmed being used at the burners.

"The Formation and Decomposition of Zinc Ferrite," by Carl E. Swartz and Francis Krauskopf, read in abstract form, was followed by three papers of written discussion, and a few oral remarks from those present. Methods of preventing the formation of this compound, and ways of decomposing it when once formed, were considered as one of the most important subjects before non-ferrous metallurgists today.

"The Metallurgical Treatment of Flotation Concentrates" was read by Colonel Arthur S. Dwight, its author, and a paper on "The Waelz Process" was read by S. S. Tuthill, the author, R. Hoffmann, being absent. Each paper aroused considerable discussion, which had to be limited owing to lack of time.

Professor Kern, of Columbia University, presented the paper on "Reduction of Roasted Cassiterite Concentrates," which he had written in co-operation with W. W. Loo. C. P. Linville took up several points in an interesting discussion of this paper, which was also participated in by others.

JOHN A. MATHEW
Recipient of the Robert W. Hunt Medal

Engineering Education

More team work between industry and engineering colleges in the problem of preparational education of the student in the period immediately after graduation was the phase of engineering education possessing the maximum latent possibilities at present, said W. E. Wickenden in prefacing his analysis of the Report of the Society for the Promotion of Engineering Education, which he presented at the meeting on Engineering Education, presided over by W. B. Plank.

Mining Geology

Instead of the single session allotted to it on the program, mining geology received a full day's consideration. Prof. R. J. Colony presided. Dr. G. F. Loughlin, of the Geological Survey, spoke briefly on his studies of ore at deep levels at Cripple Creek. Lloyd T. Emory discussed British Guiana bauxite —for him a familiar subject. Interesting lantern slides were shown by Dr. E. L. Bruce to illustrate his paper on the Red Lake and Woman Lake areas in Northwestern Ontario, one of the hardest to reach in Canada.

A lively discussion as to the status of the economic geologist in the mining industry was provoked by Dr. Waldemar Lindgren, who presented a paper on "Research in Processes of Ore Deposition." Too little research was being done, he said. His paper was largely one of complaint, he remarked. Further, the mining industry was taking away the best men from the universities, "robbing the cradle," he said. Drs. H. C. Boydell, George Otis Smith, Alan Bateman, Dr. Bruce, Dr. Loughlin, Reno H. Sales, and Dr. Charles P. Berkey, took part in the discussion.

"Sedimentary Metalliferous Deposits of the Red Beds," a paper by John Wellington Finch, stimulated an interesting discussion of the occurrences referred to.

T. S. Lovering, of the U. S. Geological Survey, described the geology of the Moffat tunnel, his remarks putting a somewhat different light on the work of the geologists who has been publicly criticized by the contractors.

Ore deposition received due attention in a paper by Dr. W. H. Emmons on "The State and Density of Solutions Depositing Metalliferous Veins."

Annual Business Session

A special business meeting, followed by the annual business meeting of the Institute, took place on Tuesday morning. Motions involving the amalgamation of the Rocky Mountain Club and the A.I.M.E. were passed unanimously, the joint organization to be known by the present Institute title. A report of the Secretary and the reports of various committees were read. The ballot was announced for the election of officers for the ensuing year, as follows: President and Director, Dr. George Otis Smith, 1,776 votes; H. N. Eavenson, 64; G. D. Barron, 4; J. E. Spurr, 2. For vice-president and director, G. D. Barron, 1,812; W. H. Bassett, 1,818; George Otis Smith, 2. Directors, H. C. Bellinger, 1,806; Karl Eilers, 1,808; H. G. Moulton, 1,807; J. V. N. Reynders, 1,805; and R. E. Tally, 1,816. Dr. Smith was therefore declared duly elected. Speeches by the retiring president, E. L. DeGolyer, and Dr. Smith followed. Mr. DeGolyer spoke briefly on what he termed the philosophy of minerals, as descriptive of the breadth of scope of the Institute's work, and paid a high compliment to the co-operation of Dr. Bain, the secretary. Dr. Smith claimed that more engineers were needed in Washington, not only in Congress but in every other strategic position in the national capital. He announced that Dr. Bain would continue with headquarters in New York, but that he, Dr. Smith, would maintain an Institute office in Washington. Col. A. S. Dwight made a plea for co-operation in the raising of funds for the engineers' memorial at Louvain, and some time was devoted to an exposition of the aims and objects of the forthcoming Engineering Congress in Japan in 1929, the program for which will comprise, under three separate headings, "The Engineer," "Engineering Education," and "Engineering Technique, Research, and Methods."

Dr. Bain announced that a joint meeting of the A.I.M.E. and the Western Division of the American Mining Congress would be held in Los Angeles in October, and that a visit to Newfoundland was planned, also, in the autumn. A symposium on geophysical prospecting will be held in Boston some time during the latter part of 1928.

Personal Notes

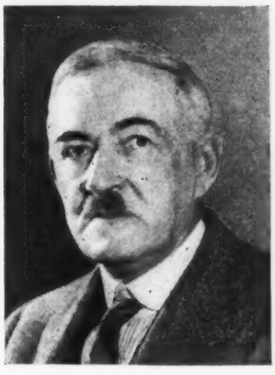
M. C. LAKE, geologist, and Mrs. Lake are in New Orleans.

H. D. KEISER, assistant editor of *Engineering and Mining Journal*, left New York today for Salt Lake City.

CHARLES R. KUZELL was at the United Verde headquarters in New York last week.

DR. EDWARD H. KRAUS, of the University of Michigan, was a recent visitor to New York in connection with the publication of a new book on mineralogy.

DR. G. E. LADD was recently appointed consulting geologist for the



G. E. LADD

Armco Culvert Manufacturers Association. Dr. Ladd has had wide experience, largely academic, in geologic work, in addition to having served, at various times, with United States, Missouri, and Texas geological surveys.

DR. OTTO SUSSMAN, vice-president of American Metal, returned to his New York office last week after an extended trip abroad.

H. L. BROWN, mining engineer for American Metal, with headquarters in Denver, was in New York last week, following a trip to Cuba.

AMOS F. KEENE, consulting engineer, is in Rouyn, Quebec, making an examination of the Salmo-Malartic property with a view to the erection of a concentrating plant.

N. W. RICE, vice-president and manager in charge of operations of the United States Smelting, Refining & Mining Company, is making his annual tour of inspection.

B. L. JOHNSON, who has been in charge of the Foreign Statistics section of the Bureau of Mines, has been transferred to the Non-Metals division in order to make a study of phosphates and nitrates.

CHARLES HOYLE, formerly manager of the Esperanza Mining Company, of El Oro, Mexico, has accepted the position of resident manager of the Cia. de Cobre Magistral Ameca and is now in charge of its mines at Ameca, Jalisco, Mexico.

HUGH S. SPENCE, of the Canadian Department of Mines, Ottawa, has been spending a week or two in the vicinity of New York, investigating opportunities for the marketing of Canadian nonmetallic minerals.

A. A. ZENTNER, metallurgical engineer, of San Francisco, and S. B. MCCLUSKEY, of the Mexican Corporation's staff at Fresnillo, are in England consulting with the officials of the Chemical and Metallurgical Corporation regarding the erection of an electrolytic zinc plant.

DR. OLIVER BOWLES has been chosen to head the Bureau of Mines section of structural materials. For three years Dr. Bowles has been superintendent of the Non-Metals Experiment Station at New Brunswick, N. J. The structural materials section is about to undertake an important study of stone resources in co-operation with the Sand and Gravel Association.

E. H. ROBIE, associate editor of *Engineering and Mining Journal*, has just left on a field trip to visit mining properties in the Southwest. His tentative plans include a stop in Salt Lake City the last two or three days of this month; at Kingman, March 3 to 5; at Jerome and Phoenix, March 6 to 8; at Globe, Superior, Hayden, and Tucson, March 9 to 17; and in southern Arizona from March 18 to 24.

D. W. JESSUP sailed on the "Minnewaska" for London on Feb. 11, with Mrs. Jessup and their two sons. After a short visit in London they will proceed to Rhodesia, where Mr. Jessup assumes the post of assistant manager for the Broken Hill Mining Corporation, in which the Anglo-American Corporation is the dominating influence. Mr. Jessup has for many years been assistant superintendent of the Midvale, Utah, smelter of the United States Mining, Smelting & Refining Company.

OBITUARY

MICHAEL H. SULLIVAN, of Kellogg, Idaho, manager of the Bunker Hill smelter, died on Feb. 12, as a result of injuries received in an automobile accident, which occurred about two weeks previous near Wallace. Mr. Sullivan was 43 years old. He is survived by his wife and three children. He was a native of Canada and was a graduate of McGill University school of mining and metallurgy. For several years, up to 1917, he was connected with the Consolidated Mining & Smelting Company of Canada, at Trail, B. C. Upon the completion of the Bunker Hill smelter at Kellogg in 1917 he accepted a position with Bunker Hill & Sullivan as manager of the smelter, which he held at the time of his death.

ALBERT C. LUDLUM, president of the New York Engineering Company, died in New York, Feb. 15. Mr. Ludlum was 60 years old. He was born in Brooklyn, N. Y. His career embraced many fields. His particular connection with mining resulted from the manufacture and use of gold dredging machinery. In 1896 he organized the New

A. C. LUDLUM

York Engineering Company. He later organized the Ludlum Engineering Corporation, of which mention was made in the *E. & M. J.* of Feb. 11. Mr. Ludlum's success in the field of engineering is the more remarkable since he never attended a college course in engineering.

MAX J. H. FRANCKE, mining engineer, died in London recently after a very brief illness. His career was a notable one. Born and educated in Germany, he went to the Transvaal in the early nineties as assistant to State Mining Engineer Klimke. In consequence it fell to Mr. Francke's lot to manage some of the mines which were taken over and operated by the Transvaal Republic during the Boer War. He became a British subject, and remained in South Africa for a decade after that war. His influence on the excellent mining legislation of that period is widely recognized. He became consulting engineer to Goertze & Company (now the Union Corporation) and rose to the position of managing director. For some years, also, he was a director of the Central Mining Corporation. Since 1922 Mr. Francke had been associated with A. Chester Beatty, in London, in the development of diamond and copper mines in Africa. At the time of his death he was a director of Selection Trust Limited, Consolidated African Selection Trust, African Selection Trust, Anglo African Exploration, Bwana M'Kubwa Copper Mining, Roan Antelope Copper Mines, Santa Gertrudis, and other important companies.

Book Review

LEACHED OUTCROPS AS GUIDES TO COPPER ORE. By Augustus Locke. The Williams and Wilkins Company, Baltimore, 1926.

THIS volume of 175 pages and 24 pages of plates is the result of a systematic study of the outcrops of copper ores and their relations to the deposits that underlie the outcrops. In this investigation the outcrops of the disseminated copper ores in porphyry and closely related ores were given particular attention. Such ores, the low-grade materials that are found below them, and the capping of the ores may with great assurance be assumed to represent the materials of a single series, parts of which have gone through the characteristic changes by surface weathering and enrichment. The protore is low-grade metallized rock below the ore, not itself workable, but which may become workable by deposition of chalcocite and associated secondary copper sulphides. The metore as defined by Locke is "after ore," a term including both gossan and capping below gossan, which have resulted from oxidation and leaching of the ore. The protore, ore, and metore commonly have similar structures and textures, and it is generally assumed that ore and metore were once essentially similar to the protore that is now found below the ore. The method of attack was systematic study of leached capping of ore and of lean pyritic material in and around explored bodies of disseminated copper ores.

An outstanding conclusion of the investigation is that the metore that is derived from a protore high in copper will show little iron deposited far away from the original copper-iron sulphide. The iron precipitate tends to form at the place of the oxidizing sulphide when that sulphide is rich in copper and away from the place of the sulphide when the sulphide is rich in pyrite.

The limitations of the thesis stated above were taken up and oxidation of copper-iron sulphides in different gangues was studied. It was found that limonite cubes replacing pyrite in calcite or limestone are common, and in calcite gangue the conclusion stated will not apply. Except calcite, the various gangues are thought to enter the reactions of surface alteration chiefly after the oxidation of the iron-copper sulphides has been completed and to affect the behavior of the iron only after it has migrated from the place of the original sulphide.

The gangues themselves were studied, and it was found that certain gangues are characteristic and that certain fine-grained mixtures of minerals survive unimpaired to the outcrop. An outcrop lacking these minerals gives little promise of underlying disseminated ore. Disseminated ore, moreover, is porous and a porous ore will have a porous outcrop. A non-porous outcrop is discouraging.

Since a carbonate delays the leaching of the heavy metals, the presence of carbonate in the outcrop is significant. An outcrop ore with carbonate and not more than 0.5 per cent of copper is presumed to represent a sulphide ore containing not more than that amount before oxidation. With all other gangues copper is often leached out.

Certain details of texture of the capping are taken up and discussed and the capping above ore with copper-iron sulphides is compared with the capping above material with little copper and abundant pyrite. A coarse box-work pattern of limonite is regarded as indicating only mixtures of chalcopyrite and pyrite. Relic sulphides commonly remain in the capping of disseminated ore: Pyrite tends to survive beyond other sulphides; covellite and enargite are resistant, but less so; chalcopyrite, bornite, and chalcocite are still less resistant, but still are sometimes preserved; and sphalerite is but seldom preserved. Galena, though rapidly oxidized, is often protected by its own oxidation products.

The discovery of a principle and the statement of a theory are not more important than working out their limitations. This the author has aimed to do. He has stated the hypotheses clearly but cautiously, and has defined their limitations. In summarizing the work I quote the last paragraph of the volume:

"The study so far accomplished, then, may be regarded as a foothold in the problem of leached outcrops as guides to copper ore. The result has been definite but limited in range, and, from this result, excursions are now needed into other parts of the problem, covering not only capping but also gossan. That such excursions can be made, and that, through the effort of qualified workers, phenomena now in a state of confusion can be brought into an orderly display, is, in the light of present progress, a reasonable expectation."

W. H. EMMONS.

A.I.M.E.

GEOPHYSICS—Four "Technical Publications" (Nos. 50, 52, 64, and 65) on geophysics have been received from the Institute. These are, respectively, as follows: "The Eötvös Torsion Balance Method of Mapping Geologic Structure," by Donald C. Barton; "A Cartographic Correction for the Eötvös Torsion Balance," by Dr. C. A. Heiland; "Working Methods of Practical Geophysics," by Hans Haalck; and "Experiments With the Eötvös Torsion Balance in the Tri-State Zinc and Lead District," by P. W. George.

GEOLOGY—Technical Publication No. 51 A.I.M.E. "Sedimentary Metalliferous Deposits of the Red Beds." By John Wellington Finch.

GEOLOGY—Technical Publication No. 71. A.I.M.E. "The State and Density of Solutions Depositing Metalliferous Veins." By William H. Emmons.

TIN METALLURGY—Technical Publication No. 72. A.I.M.E. "Reduction of Roasted Cassiterite Concentrates." By W. W. Loo and E. F. Klein.

GEOLOGY—Technical Publication No. 78. A.I.M.E. "Research in Processes of Ore Deposition." By Waldemar Lindgren.

ARIZONA GEOLOGY—Technical Publication No. 63, A.I.M.E. "Ore Deposits Support Hypothesis of a Central Arizona Batholith." By I. A. Ettlinger.

PENNSYLVANIA GEOLOGY—Technical Publication No. 66. A.I.M.E. "Geologic Factors in the Development of the Eastern Pennsylvania Slate Belt." By Charles H. Behre, Jr.

METALLURGY—Technical Publication No. 69. A.I.M.E. "The Waelz Process." By R. Hoffmann, Clausthal, Germany.

L. O. X.—The title of Technical Publication No. 61, also received, is "Liquid-oxygen Blasting at Chuquicamata, Chile," by H. C. Schultz and F. K. Middleton Hunter.

Government Publications

MINERAL RESOURCES—Separate chapters of "Mineral Resources of the United States, 1926," have been announced as follows:

"Gold, Silver, Copper, Lead, and Zinc in the Eastern States in 1926" (preliminary summary), by J. P. Dunlop. Six pages; 5c.*

"Mineral Resources of the United States in 1926" (preliminary summary), by Frank J. Katz; of 122 pages; 20c.*

"Platinum and Allied Metals in 1926," by J. M. Hill. Ten pages; 5c.*

"Salt, Bromine, and Calcium Chloride in 1926," by A. T. Coons. Ten pages; 5c.*

"Selenium and Tellurium in 1926," by V. C. Heikes. Three pages; 5c.*

"Tin in 1926," by J. W. Furness. Twenty-two pages; 5c.*

"Silver, Copper, Lead, and Zinc in the Central States in 1926" (mine report), by J. P. Dunlop and H. M. Meyer. Thirty-five pages; 10c.*

POTASH—Bulletin 274 of the U. S. Bureau of Mines is entitled "Potash Mining in Germany and France," by George S. Rice and John A. Davis. It contains 92 pages, 25c.* In this are discussed the location and methods of working potash mines in the two countries, with a history of the industry there.

ALASKA, MINING—Bulletin 797-A, U. S. Geological Survey, entitled "Mineral Industry of Alaska in 1926 and Administrative Report." By Philip S. Smith. The bulletin contains 66 pages.

CANADA, MINING—The Department of Mines, Dominion of Canada, has issued its report for the fiscal year ending March 31, 1927. It is sold at 15c. per copy at Ottawa.

*Sold only by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

Market and Financial News

February Dividends Compare Well With Previous Quarter

MINING company dividends for February compare favorably with those for November, corresponding month in the preceding quarter. The principal losses may be attributed to the appearance of irregular payments in November. Aramayo, Plutus, and California Rand may be classified thus. However, Chief Consolidated returned to the fold after an absence of fifteen months and assists in offsetting this loss. Dome Mines, Ltd., reported a dividend in November that was expected in October; the corresponding payment for this quarter was disbursed in January, according to schedule. On the other hand, the quarterly payment of Bingham Mines, expected in January, did not make its appearance until this month and the quarterly rate was decreased from $1 to $0.75 per share. Lucky Tiger-Combination, operating in Sonora, Mexico, increased its monthly dividend from 5c. to 7c. per share.

The larger organizations continued in the usual even tenor of their ways. Freeport Sulphur added an extra 25c. to its usual disbursement, and United Verde Extension decreased its quarterly share rate by the same amount.

Mining Dividends Paid in November

Companies in the United States	Situation	Per Share	Total	Per Cent Annual Yield
American Smelting & Refining	Various	$2.00 Q	$1,219,960	4.6
Anaconda Copper, c, z, l, s	Various	0.75 Q	2,250,000	5.3
Aramayo Mines, †	Bolivia	1.25 Q*	1,050,000*	....
Bingham Mines Co., s, l	Utah	0.75 Q	37,500	6.9
Bunker Hill & Sullivan, l, s	Idaho	0.75 M	245,250	6.0
Chief Consol, s, l	Utah	0.10 I	114,286	....
Colorado Fuel & Iron, pfd	Various	2.00 Q	40,000	....
Freeport Texas, s	Texas	1.75 QX	1,277,127	5.7
Homestake Mining, g	S. D.	0.50 M	125,580	10.1
International Nickel, pfd, n., c	Ont., W. Va.	1.50 Q	133,689	5.4
Miami Copper	Ariz.	0.375Q	280,168	8.0
National Lead, pfd. l, c	Various	1.50 Q	375,000	5.3
New Cornelia Copper	Ariz.	0.50 Q	900,000	7.0
New Jersey Zinc	Various	2.00 Q	981,632	6.2
Sunshine Mining Co., s, l	Idaho	0.10 Q	30,000	26.6
U. S. Steel, pfd	Various	1.75 Q	6,305,497	4.9
United Verde Extension, c	Ariz.	0.50 Q	525,000	12.9
Vanadium Corporation	Various	0.75 Q	283,775	4.6
Companies in other countries				
Amparo Mining, g, s	Jalisco	0.01 Q	20,000	....
Cerro de Pasco, c, s	Peru	1.00 Q	1,122,842	6.2
Hollinger Consolidated Gold	Ont.	0.10 4 wks.	492,000	7.2
Lucky Tiger-Combination, g, s	Sonora	0.07 M	50,073	8.6
Teck-Hughes, g	Ont.	0.15 S. A. X.	713,574	2.7
Wright-Hargreaves (new), g	Ont.	0.05 Q	275,000	3.6
Total			$17,336,445	

c, copper; z, zinc; l, lead; s, silver; h, holding company; g, gold; n, nickel; s, sulphur; t, tin; Q, quarterly; I, irregular; SA, semi-annual; M, monthly; BM, bi-monthly; QX, $1 regular and $0.75 extra; SAX, $0.10 regular and $0.05 extra*, Swiss Francs.

STATISTICAL NOTES

STATISTICS of the mineral output of the Union of South Africa for the month of November (excluding diamonds), and for the eleven months of 1927, were recently issued by the Department of Mines. This act of ministerial secrecy, as regards the diamond output, is strongly condemned by the South African press, as the diamond industry represents ten to twelve millions sterling per annum.

	—November— 1927	—Jan. to Nov.— 1927
Gold	£3,602,569	£39,412,002
Silver	9,956	108,411
Osmiridium	3,645	49,751
Platinum	5,846	129,016
Diamonds	.....	(a) 10,536,326
Coal	321,512	3,522,676
Copper	60,335	532,051
Tin	29,533	311,193
Other minerals	37,352	436,373

(a) Ten months' production.

ALASKA JUNEAU reports an operating surplus of $105,900 in January, 1928, which stands as a record. Gross receipts on 322,450 tons was $285,000, or 88.4c. per ton.

CALUMET & HECLA CONSOLIDATED shows net profits of $582,744, or 29c. per share, in 1927, as against $1,500,318, or 74c. per share, in 1926.

NEW JERSEY ZINC'S statement for the quarter ended Dec. 31, 1927, follows:

Income, after deductions for expenses, taxes, maintenance, repairs, depreciation, depletion and contingencies.		$1,883,668.69
Add		
Dividends from subsidiary companies		100,000.00
Total income		$1,683,668.69
Deduct		
Dividend 2 per cent payable Feb. 10, 1928	$981,632.00	
Employees' profit-sharing distribution	480,000.00	1,461,632.00
Surplus for the quarter		$222,036.69

Summary for the Year

Net Income		
For the first quarter		$1,769,480.30
For the second quarter		1,975,514.28
For the third quarter		1,610,106.04
For the fourth quarter		1,683,668.69
Net income for the year		$7,038,769.31
Deduct		
12 per cent dividends declared	$5,889,792.00	
Employees' profit-sharing distribution	480,000.00	$6,369,792.00
Surplus for the year		$668,977.31

Consolidated M. & S. Makes Good Showing

Consolidated Mining & Smelting of Canada, the Dominion's largest producer of lead, zinc, gold and silver, made another remarkable showing in the year just ended. Though output of gold was only about half that of 1926 and that of copper a little under the preceding year, production of lead and zinc was substantially greater and that of silver practically the same. Regarding the operations of 1927 the company says:

"Operations are proceeding satisfactorily. There are no unsold stocks of metal. A preliminary estimate of the year's profit would indicate that notwithstanding the drop in metal prices results will fall not far short of last year." Production for the two years compares as follows:

Lb.	1927	1926	Increase	Decrease
Lead	291,042,000	262,104,000	28,938,000	.....
Zinc	147,054,000	135,092,000	11,962,000	.....
Copper,	18,524,000	21,264,000	.....	2,740,000
Oz.				
Gold,	29,490	50,075	.....	20,585
Silver,	7,179,607	7,178,817	790	.....

Production of lead showed increase of 11 per cent over 1926 and production of zinc increase of nearly 9 per cent. The 1926 figures, with which those of the past year are being compared, were much higher than those of 1925, having shown an increase of 21 per cent for lead and 60 per cent for zinc.

Production of gold showed largest relative decrease, being down 41 per cent as compared with 1926. It must be remembered, however, that during 1926 the gold output of the company took a tremendous upturn, having increased 150 per cent over 1925. The 1927 gold output is still considerably above that of 1925. Silver production remained practically unchanged, the increase amounting in 1927 to a small fraction of 1 per cent.

Output of copper took a drop of nearly 13 per cent compared with 1926. Copper production, it will be recalled, was initiated toward the close of 1925 and only 183 tons was produced in that year. In 1926 production increased very rapidly and a total of 10,632 tons constituted the year's output. In 1927 the high rate of production was not fully maintained, output declining to 9,262 tons.

JANUARY COPPER PRODUCTION by United States mines in 1928 was 68,728 tons; 76,198 tons in January, 1927; and 71,026 tons in January, 1926, according to statistics just released by the American Bureau of Metal Statistics. In spite of this fact, stocks at the end of January, 1928, amounted to 96,476 tons, an increase of 548 tons during the month. Producers interpret these statistics to indicate a potential buying wave.

UNION MINIÈRE DU HAUT-KATANGA, reports January copper production of 10,528 tons, a decrease of 448 tons from December, 1927, production.

The Market Report

Metal Markets Continue Disappointing—Lower Prices for Lead and Zinc

New York Feb. 22, 1928 — Metal sellers were well content to take a holiday today, it being Washington's birthday, as prices have been generally unsteady during the last week and business has been less than was hoped. Lead and zinc have both suffered slight reactions downward in price, and the market is rather weak. Copper is substantially unchanged, with the large producers maintaining a uniform front at 14⅛c., delivered, or about an eighth of a cent above the level asked by the more urgent sellers. Silver and tin, also, are in about the same position as a week ago. In general, metal business so far this year has not been so good as expected when the year-end forecasts were made, but it is likely that March will see an improvement, as most metal consumers are apparently underbought.

Daily Prices of Metals

Feb.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
16	13.775@13.875	51.00	51.625	6.30@6.35	6.00@6.10	5.50@5.55
17	13.775@13.875	51.375	52.00	6.30@6.35	6.00@6.05	5.50@5.55
18	13.825	51.50	52.125	6.30@6.35	6.00@6.025	5.50
20	13.775	51.00	51.50	6.20@6.25	6.00	5.475
21	13.775	50.875	51.375	6.20@6.25	5.95@6.00	5.45
22	Holiday	.....	.....	....	.....	.....
	13.805	51.150	51.725	6.285	6.013	5.495

Average prices for calendar week ending February 18, 1928, are: Copper, 13.830; 99 per cent tin, 51.225; Straits, 51.800; N. Y. lead, 6.325; St. Louis lead, 6.048; zinc, 5.545; and silver, 57.150.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary form of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.13c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Feb.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
16	62 1/16	61 3/4	66 1/2	229 3/4	232 3/4	20 1/8	20 5/8	25 5/8	25 5/8
17	61 3/4	61 7/16	66 1/2	231 1/4	234	20 1/16	20 9/16	25 5/8	25 9/16
20	61 1/2	61 3/16	66 1/2	230	233	19 7/8	20 3/8	25 5/16	25 3/8
21	61 3/16	60 15/16	66 1/4	227 3/4	230 1/2	19 11/16	20 1/16	25 1/16	25 1/16
22	61 3/16	60 7/8	66 1/4	228 1/4	231	19 3/4	20 3/16	25	25 1/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Feb.	Sterling Exchange "Checks"	Silver		Gold London	Feb.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
16	4.86 7/8	57	26 3/16	84s11 1/2d	20	4.87	57 1/4	26 3/16	84s11 1/2d
17	4.86 15/16	57 1/4	26 1/4	84s11 1/2d	21	4.87 1/4	57 1/4	26 3/16	84s11 1/2d
18	4.87	57 1/8	26 1/8	.....	22	Holiday	.....	26 1/4	84s11 1/2d
					Avg.		57.175		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Copper Buyers Still Holding Off

The copper market is unchanged from last week, with the exception that some of the custom smelters are having even more difficulty in finding buyers at 14c., delivered in the East, and even that price might be shaded slightly on attractive business. However, only an occasional consumer is showing any interest in the market, and every one is waiting until the last minute to buy. Perhaps half of March requirements are as yet unbooked, so that when the buying movement begins, in all probability within a week or so, there should be an urgent demand for prompt shipment. The large producing group continues to quote 14⅛c., delivered Valley, there having been no breaks in the ranks during a three months' lull in buying.

The brass mills continue active, but not up to the rate of a year ago, and advance bookings are disappointing. Wire business is also slack.

The foreign market continues quiet and unchanged at 14½c., c.i.f.

Further Decline in Lead

Lead prices declined further in both domestic and foreign markets during the week ending today. Spot metal in London broke through £20 on Monday and a further decline took place today. On Monday the American Smelting & Refining Company reduced its contract price from 6.35c. to 6.25c., New York, the second reduction within a week. The leading interest in the Middle West maintained its asking price at 6.10c. until Monday, when several orders were taken at 6.00c. However, lower prices were named on sales in both the East and West all week by sellers in the outside market. Concessions were not effective in stimulating business to any great extent, and the total volume of sales was decidedly small. Recognizing the weakness of the position for the moment, buyers are naturally inclined to wait in the hope that further declines in London may be followed by reductions in the domestic market. Today it is profitable to sell bullion lead refined in bond in the American market rather than to export it. Several transactions involving small lots were closed today at 6.25c.; but, on the other hand, one seller found it impossible to develop any interest by offering at considerable concessions from this level.

With respect to the decline in London, *The Metal Bulletin* says "There does not seem to be any particular factor depresing the market other than the poor statistical position, but confidence is lacking."

Zinc Sales Better, But Prices Drop ⅛c.

Zinc has been in better demand during the last week, the lower prices apparently being attractive to some galvanizers. Orders have been well dis-

tributed over February, March, and April, the later deliveries commanding about 2½ points' premium over prompt shipment. On Monday and Tuesday there was a perceptible weakening in prices, both in London and here, and late on Tuesday spot zinc might have been obtained for 5.425c., St. Louis.

Tin Under 51½c.

The downward course of the tin market continues, although there was a temporary reaction upward last Thursday and Friday. Buying in the domestic market has been very quiet, the anxiety of sellers of spot metal meeting with little response. Tin of 99 per cent grade is scarce, and the spread between it and Straits is only about ½c. per pound. March and April in the domestic market are about ⅛c. under prompt, but in London a contango of £3 prevails.

Silver 57¼c.

The silver market continues quiet and steady, with the chief support coming from China. Fluctuations, both here and abroad, have been extremely narrow, and no factors indicating a material change are apparent. Silver has really been the steadiest of any of the non-ferrous metals in the last week or two, with the possible exception of copper.

Mexican Dollars (Old Mexican pesos): Feb. 16th, 43⅜c.; 17th, 43⅞c.; 18th, 43¾c.; 20th and 21st, 43⅞c.; 22d, holiday.

Sterling Stronger

Sterling exchange showed increased strength during the week. Closing cable quotations on other important foreign exchanges on Tuesday, Feb. 21, were as follows: Francs, 3.93$\frac{15}{16}$c.; lire, 5.29⅝; and marks, 23.875c.; Canadian dollars, $\frac{13}{64}$ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 98 or 99 per cent grades, price of leading interest, 24.30c.; outside market, 23.90@24.30c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, spot business, range for the week 10½@10¾c. Forward positions somewhat stronger.

Cookson's "C" grade, spot, 16⅜c. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, Chinese, 99 per cent Sb_2O_3, 15½c.

BISMUTH—Per lb., New York, in ton lots, $2.10. Smaller lots, $2.25 and up.

IRIDIUM—Per oz., $340@$360 for 98@99 per cent sponge and powder. Market apparently oversold.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM—Per oz., $49@$52. Small lots bring up to $56. Absolutely no activity in market.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $85. Dealers and refiners quote the trade for refined metal, per oz., cash, $79@$82. Market very dull.

QUICKSILVER — Per 76-lb. flask, $119@$121, depending on quantity. San Francisco wires $125.

Prices of Cadmium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Feb. 4.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn. c.i.f. North Atlantic ports. minimum 47 per cent Mn; 35@38c. Caucasian, washed, 53@55 per cent, 38.50@40c. Chemical grades unchanged from quotations in the Feb. 4 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10.25@$10.50. Western scheelite, $10.50@$10.75. Market dead; prices nominal.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the Feb. 4 issue.

Zinc Ore Again Lowered—Lead Unchanged

Joplin, Mo., Feb. 18, 1928

Blende		
High		$40.20
Premium blende, basis 60 per cent zinc	$36.00@	37.00
Prime Western, basis 60 per cent zinc		35.00
Slimes and fines, 60 per cent zinc	32.00@	34.00
Average settling price, all zinc		36.51
Galena		
High		$86.80
Basis 80 per cent lead		80.00
Average settling price, all lead		84.26

Shipments for the week: Blende, 10,814; lead, 2,140 tons. Value, all ores the week, $575,150.

Buyers succeeded in purchasing 8,510 tons this week, about one-third of which was bought early in the week on the price current last week, the balance on a cut price of $1 per ton. Sellers in Kansas are faced with a tax assessment on the first of March, and they think the price was lowered to force them to accept a low price or stand for the assessment. Holders of lead ore in Kansas disposed of a part of their holdings to avoid the assessment.

Production continues around 12,000 tons per week, with the average shipment this year at 10,200 tons per week.

Platteville, Wis., 2-18-1928

	Per Ton
Zinc Blende	
Blende, basis 60 per cent	$38.75
Lead Ore	
Lead, basis 80 per cent lead	$86.00

Shipments for the week: Blende, 645 tons; lead, 160 tons. Shipments for the year: Blende, 5,011 tons; lead, 520 tons. Shipments for the week to separating plants: 1,015 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Feb. 4 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. A few good sales made.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Feb. 4 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or c.i.f. port of entry, $100 quoted for first quarter, 1928. Spiegeleisen, 19@21 per cent, $31@$32 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 92@94c. f.o.b. works. Dullness expected for several months.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Feb. 4 issue.

Metal Products

ROLLED COPPER—Sheets, 22¾c.; wire, 16@16¼c. per lb., f.o.b. mill.

LEAD SHEETS—Full rolled, 10c. per lb.; clipped, 10¼c.

NICKEL SILVER—29¼c. per lb. for 18 per cent nickel Grade A sheets.

YELLOW (MUNTZ) METAL—Dimension sheets, 19¾c. per lb.; rods, 16¾c. per lb.

ZINC SHEETS—10c. per lb., f.o.b. works.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the Feb. 4 issue.

Iron, Steel, and Coke

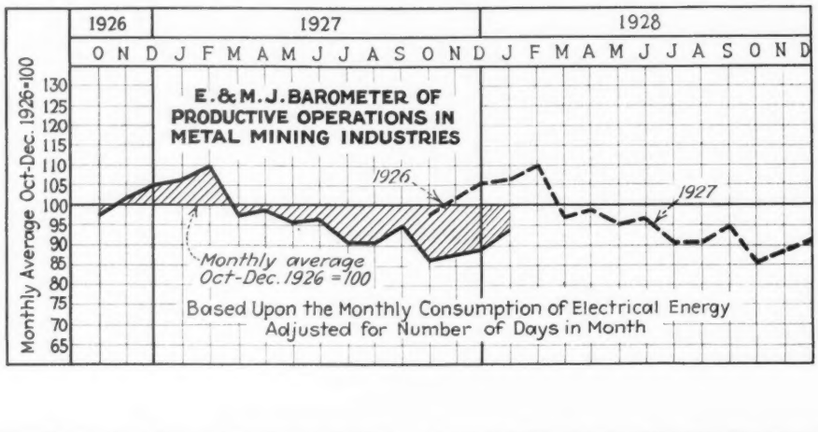
Iron—Per gross ton, Valley furnaces, Bessemer, $17.50; basic, $17; No. 2 foundry, $17.25.

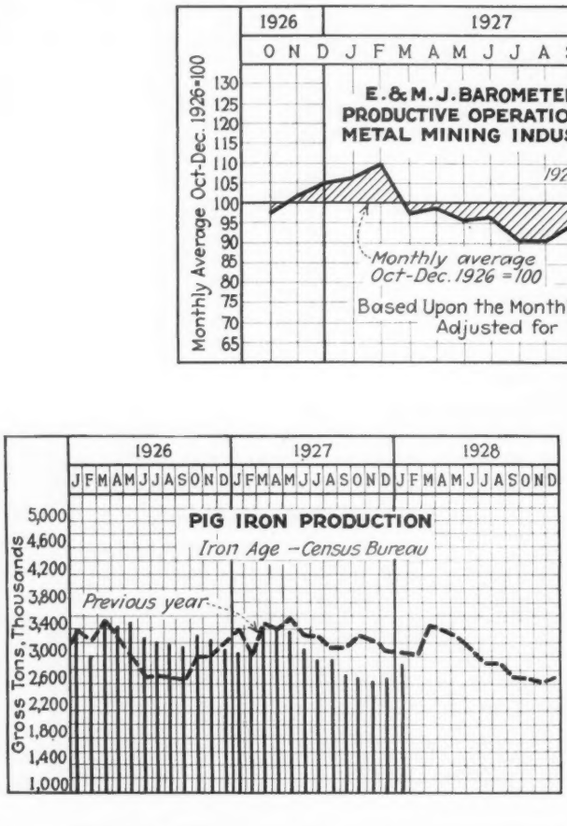
Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85c.

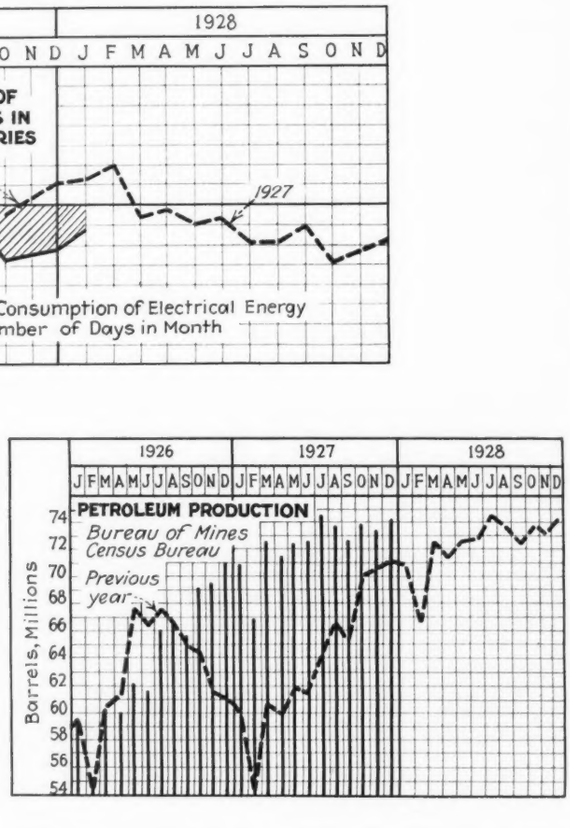
Coke—Per gross ton, Connellsville furnace, contract, $2.85@$3; spot, $2.75@$2.85. Connellsville foundry, contract, $3.75@$4.25; spot, $3.75@$4.25. By-product coke, Ohio and Kentucky, $7.50; Buffalo and Detroit, $9.

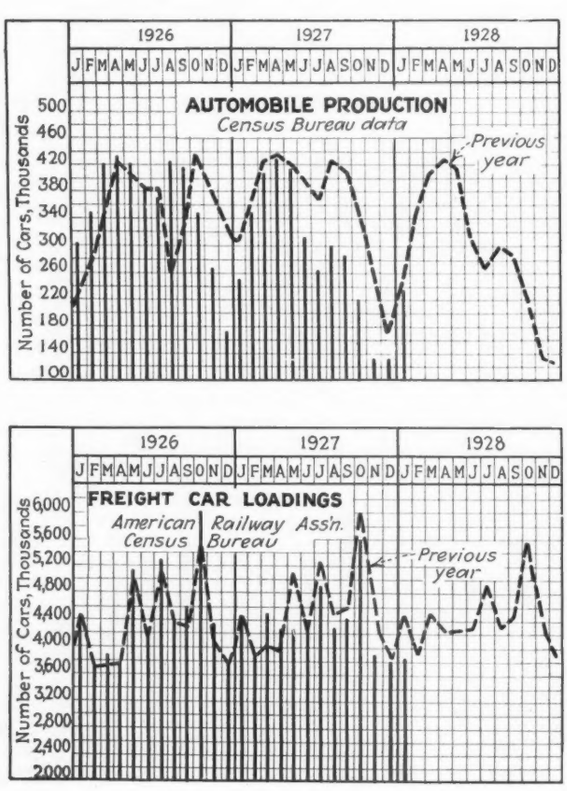
Indicators of Industrial Activity

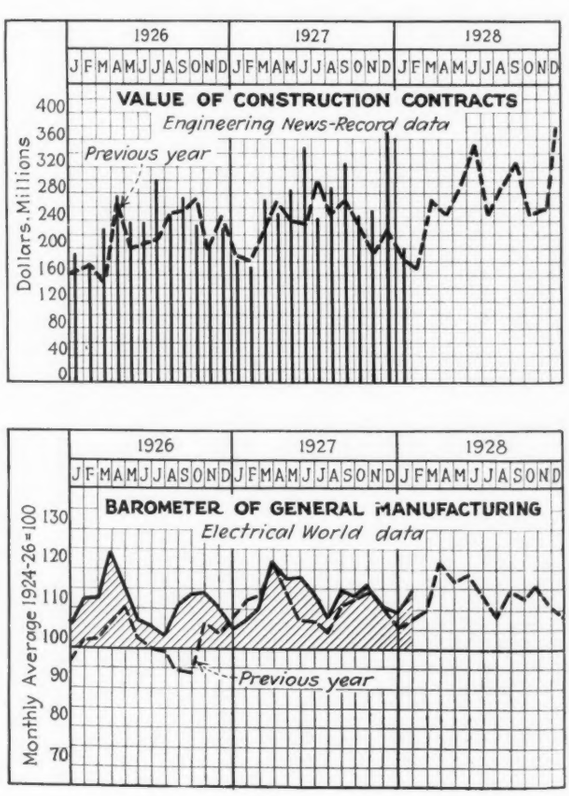
of Significance to Mining


1926
1927
1928
O N D J F M A M J J A S O N D J F M A M J J A S O N D
E. & M. J. BAROMETER OF PRODUCTIVE OPERATIONS IN METAL MINING INDUSTRIES
1926
1927
Monthly average Oct-Dec. 1926 = 100
Based Upon the Monthly Consumption of Electrical Energy Adjusted for Number of Days in Month
Monthly Average Oct-Dec. 1926=100
130 125 120 115 110 105 100 95 90 85 80 75 70 65

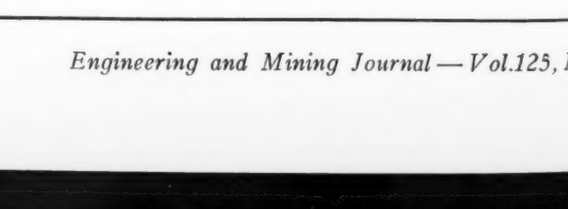

1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
PIG IRON PRODUCTION
Iron Age – Census Bureau
Previous year
Gross Tons, Thousands
5,000 4,600 4,200 3,800 3,400 3,000 2,600 2,200 1,800 1,400 1,000


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
PETROLEUM PRODUCTION
Bureau of Mines
Census Bureau
Previous year
Barrels, Millions
74 72 70 68 66 64 62 60 58 56 54


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
AUTOMOBILE PRODUCTION
Census Bureau data
Previous year
Number of Cars, Thousands
500 460 420 380 340 300 260 220 180 140 100


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
VALUE OF CONSTRUCTION CONTRACTS
Engineering News-Record data
Previous year
Dollars, Millions
400 360 320 280 240 200 160 120 80 40 0

1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
FREIGHT CAR LOADINGS
American Railway Ass'n.
Census Bureau
Previous year
Number of Cars, Thousands
6,000 5,600 5,200 4,800 4,400 4,000 3,600 3,200 2,800 2,400 2,000


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
BAROMETER OF GENERAL MANUFACTURING
Electrical World data
Previous year
Monthly Average 1924-26=100
130 120 110 100 90 80 70

Mining Stocks—Week Ended February 18, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	59	54½	54½	Ja.14, Fe.20 Q	0.75
Arcadian Consol.	Boston	4¾	4¼	4¼		
Ariz. Com'l	Boston	5¼	4¼	4¼	Ja. 19, Ja. 31	0.25
Calumet & Hecla	Boston	23	20½	20¾	No.30, De.15 Q	0.50
Cerro de Pasco	New York	65¾	62½	63	Ja.12, Fe 8 Q	1.00
Chile Copper	New York	41¼	38	38¼	Ma. 2, Ma. 30Q	0.62
Con. Coppermines	N. Y. Curb	6¼	6	6		
Copper Range	Boston	17¼	16	16	Ap.2, My.2, A	1.00
Crystal Copper	Bos tonCurb	*67	*56	*60		
East Butte	Boston	1¾	1	1⅛	Dec. 1919	0.50
Granby Consol	New York	42¾	39½	39½	Jn.15 Jy. 1 Q	1.00
Greene Cananea	New York	137½	113	114	Nov., 1920	0.50
Howe Sound	New York	44½	40¾	41¼	De.31, Ja.16, Q	1.00
Inspiration Consol	New York	20¼	18¾	18¾	Ma.17, Ap.4, Q	0.25
Iron Cap	Boston Curb	3¼	3¼	3¾		
Isle Royale	Boston	13¼	12¼	12¾	Fe. 28, Ma. 15	0.50
Kennecott	New York	86¼	80¼	80¼	De. 2, Ja 3 Q	1.25
Magma Copper	New York	51	45	45	De.30, Ja.17 Q	0.75
Mason Valley	N. Y. Curb	1¾	1¼	1¼		
Miami Copper	New York	19¾	18	18	Fe.1, Fe.15, Q	0.37½
Mohawk	Boston	49	47	47½	Ja. 28, Ma. 1 Q	1.00
Montana-Idaho	Spokane	*53	*48½	*53		
Mother Lode Coal	New York	3	2¼	2¾	De.16, De.31	0.25
Nevada Consol	New York	21¼	18¾	19½	De.16, De.31 Q	0.37½
New Cornelia	Boston	28	27¼	27½	Fe. 3, Fe. 20 Q	0.50
Noranda	N. Y. Curb	19¾	18¼	18¾		
North Butte	Boston	1¼	1	1⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*91	*81	*89	Sept. 1926	0.03
Old Dominion	Boston	10½	10	10	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	124¾	121¼	121½	De.17, Ja.3 Q	1.50
Quincy	Boston	13¾	12¾	13¾	March, 1920	1.00
St. Mary's Min. Ld.	Boston	28¼	26	26½	Fe.10, Ma.10	2.00
Seneca Copper	New York	2¾	2½	2½		
Shattuck-Denn	N. Y. Curb	17½	14	14¾		
Tenn. C. & C.	New York	11¼	10¼	10¼	Fe.29, Ma.15, Q	0.12½
United Verde Ex.	N. Y. Curb	23¼	22	22	Ja.4, Fe.1 Q	0.50
Utah Copper	New York	140	140	140	De.16, De.31 Q	1.50
Utah Metal & T.	Boston	1¼	1¼	1¼	Dec., 1917	0.30
Walker Mining	Salt Lake	*85	*74	*74		
NICKEL-COPPER						
Internat. Nickel	New York	93¾	83¼	93¾	De.16, De.31 Q	0.50
Internat. Nickel pfd.	New York	...	...	112½	Fe. 17, Ma. 1 Q	0.62½
LEAD						
Gladstone Mtn	Spokane	*8¼	*8	*8	June, 1927	0.005
National Lead	New York	132¾	129	129	Ma.16, Ma 31 Q	1.25
National Lead pfd	New York	139	139	139	Ap.23, My.1 Q	1.50
St. Joseph Lead	New York	41¼	40¼	40¾	Ma.9, Ma.20, QX	0.75
ZINC						
Am. Z. L. & S.	New York	18¾	12¼	13¼	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	73¼	61¾	65	Nov., 1920	1.50
Butte C. & Z.	New York	4¾	4¼	4¾	De. 9, De. 24	0.50
Butte & Superior	New York	11¾	9¼	9¾	De.16, De.31 Q	0.50
Callahan Zn-Ld	New York	2¼	2	2	Dec., 1920	0.50
Consol.Lead&Zinc'A'	St. Louis	14	14	14	Ma.15, Ap.1 Q	0.25
Eagle-Picher	Cincinnati	19	18	19	No.15, De.1 Q	0.40
Eagle-Picher pfd.	Cincinnati	115	113¾	113¾	Jn.30, Oc.15 Q	1.50
New Jersey Zn	N. Y. Curb	191¾	190	190	Ja. 20, Fe. 10	2.00
Treadwell-Yukon	Toronto	27	27	27		
United Zinc	N. Y. Curb	....	....	25		
Yellow Pine	Los Angeles	....	....	*25	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	4	3¼	3¼		
Argonaut	Toronto	*25	*22½	*23		
Barry-Hollinger	Toronto	*82½	*75½	*79½		
Central Manitoba	Toronto	1.66	1.50	1.50		
Con.W.Dome L. new.	Toronto	*15½	*13½	*15		
Cresson Consol. G.	N. Y. Curb	2¼	2¼	2¼	Ma.31, Ap.10 Q	0.10
Dome Mines	New York	12¾	11¼	11¾	Ma. 31, Ap. 20Q	0.25
Golden Cycle	Colo.Springs	†1.75½	†1.75	...	Fe.29, Ma.10 Q	0.04
Gold Hill	Toronto	*26	*24	*25		
Hollinger Consol.	Toronto	17.75	17.00	17.15	Ja.1, Ja.27 M	0.10
Homestake Mining	New York	70	70	70	Fe.20, Fe.25 MX	1.50
Kirkland Lake	Toronto	2.10	1.87	1.88		
Lake Shore	Toronto	23.50	22.50	22.50	Ma 1, Ma.15 QX	0.40
McIntyre-Porcupine	New York	26½	25½	26½	Fe. 1, Ma. 1 Q	0.25
Portland	Colo.Springs	†*25	†*18	...	Ap.6, Ap.15, Q	0.02
Rand Mines	New York	...	...	43¼	Au.22-29 Am.Sh.	1.52
Sylvanite	Toronto	3.35	3.25	3.25		
Teck-Hughes	Toronto	9.00	8.45	8.65	Fe.1, X	0.15
Tom Reed	Los Angeles	*35	*33	*33	Dec., 1926	0.02
Tough-Oakes	Toronto	*64	*55½	*62		
United Eastern	N. Y. Curb	*72	*61	*65	July, 1924	0.05
Vipond Cons	Toronto	*55	*53	*53	Apr.1, Apr.15	0.03
Wright-Hargreaves	Toronto	4.75	4.45	4.50	Ja. 17, Fe. 1	0.05
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	25¾	21¾	22¾		
Con. Cortez	N. Y. Curb	...	...	*19		
Dolores Esperanza	N. Y. Curb	*50	*50	*50	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	...	...	...		
Premier Gold	N. Y. Curb	2¼	2¼	2¼	De. 15, Ja. 4	0.08
Tonopah Belmont	N. Y. Curb	1¾	1¾	1¾	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb	*11	*10	*10	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	5	4 5/16	4¾	Se.20, Oc.21	0.07½
West End Consol	N. Y. Curb	...	...	*5	Mar., 1923	0.05
Yukon Gold	Boston Curb	...	...	*70	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.66	1.45	1.45	May, 1920	0.03
Castle-Trethewey	Toronto	*66	*65	*66		
Coniagas	Toronto	...	...	4.90	May, 1924	0.12½
Keeley	Toronto	*63	*61	*62½	Se.1, Se.15	0.08
Lorrain Trout Lake	Toronto	...	...	*60	July, 1925	0.05
Mining Corp. Can.	Toronto	4.00	3.75	3.75	Ja.10, Ja.25	1.50
Nipissing	N. Y. Curb	5¼	4¾	5	De. 31, Ja.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3¼	3¼	3¼	Ma. 25, Ap.4 QX	0.12½
Bingham Mines	Boston	56	53¼	53¾	Ja. 21, Fe. 1 Q	0.95
BunkerHill&Sullivan	N. Y. Curb	160	150	152½	Ja.31, Fe 4 NX	0.75
Cardiff M. & M.	Salt Lake	*70	*62	*62	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	4.72½	4.00	4.67½	Ja.10, Fe.1 Q	0.10
Consti'nMng.&Mill'g	Spokane	*20	*15	*15		
Erupcion	Boston Curb	*50	*48	*50	De.17, Ja.3 Q	0.07½
Eureka Lily	Salt Lake	2.70	2.25	2.55		
Federal M. & S.	New York	...	...	140	Jn.25, Jn.29 Spec.	$10
Federal M. & S. pfd.	New York	96	95	95	Fe.24 Ma.15 Q	1.75
Hecla Mining	N. Y. Curb	17½	17¼	17½	No.15, De.15 Q	1.75
Highland-Surprise	Spokane	*15	*14	*14		
Iron King Mining	Salt Lake	*75	*69	*69		
Keystone Mining	Salt Lake	*27	*26	*27	Au. 12, Au. 26	0.07½
Lucky Jim	Spokane	*43½	*34½	*43		
Lucky Tiger-Com.	Kansas City	†8.00	†7.85	....	Fe.10, Fe. 20	0.07
Mammoth Mining	Salt Lake	2.15	2.10	2.15	Jn.10, Jn.20 Q	0.05
North Lily	Salt Lake	5.95	4.95	5.90		
Park Utah	New York	12	10	10½	De. 15, Ja. 3 Q	0.20
Plutus Mining	Salt Lake	....	....	2.40	Oc. 25, No. 10 Q	0.10
Silver King Coal	Salt Lake	11½	10¾	10¾	De. 24, Ja.2 X	0.35
Silversmith	Spokane	*20	*18½	*19	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*49	*47	*47½		
Sunshine M. Co.	Spokane	1.50	1.40	1.40		
Tamarack-Custer	Spokane	1.20	1.03	1.20	Sept., 1924	0.25
Tintic Standard	Salt Lake	16	15	15	De.20, Ja.3 QX	0.40
Utah-Apex	Boston	4¼	4¼	4¼	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	61¾	56¾	56¾	Se. 2, Oc.1	1.75
Cleveland-Cliffs Iron	Cleveland	110	106	107	Ja.13, Ja.25 Q	1.00
Colorado Fuel & Iron	New York	79½	71	71¼	May, 1921	0.75
Gt. North'n Iron Ore	New York	24⅝	21	21	Dec. 6, Dec. 28	0.75
Inland Steel	New York	58	48	48	Fe.15 Ma.1 QX	0.66¾
Replogle Steel	New York	...	...	12¾		
Republic I. & S.	New York	64¾	56	58	Fe. 15, Ma.1 Q	1.00
Republic I. & S. pfd.	New York	111	108	108	Ma. 15, Ap. 2 Q	1.75
Sloss-Sheffield S. & I.	New York	...	...	131	De. 10, De. 20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	119	De. 20, Ja.3 Q	1.75
U. S. Steel	New York	146¾	139¼	140	No. 30, De. 30 Q	1.75
U. S. Steel, pfd.	New York	139¾	139	139½	Oc.30, No. 29 Q	1.75
Virginia I. C. & C.	New York	...	...	34	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York	62¼	60	60	De. 16, Ja. 3	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	...	...	24	Jn. 26, Jn.30	1.45
So. Am. G. & P. New.	N. Y. Curb	3	2¾	3		
Alum. Co. of Amer.	N. Y. Curb	136	124½	124½		
Alum. Co. of Amer. pf.	N. Y. Curb	106¾	106¼	106¼	De. 15, Ja1 Q	1.50
Vanadium Corp.	New York	88¾	77¼	77¼	Fe. 1, Fe. 15 Q	0.75
Patino M. & E.	New York	26¼	24	24¼	De 31, Ja. 14	4s.
ASBESTOS						
Asbestos Corp.	Montreal	34¼	33	33¼	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	95	94¼	94¼	De.31, Ja.16 Q	1.75
SULPHUR						
Freeport Texas	New York	85¾	66¼	66¾	Ja.14, Fe.1 QX	1.75
Texas Gulf	New York	73¼	68¼	68¼	Ma.1, Ma.15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	43¾	40	40¼	Fe.18, Ma.1 Q	0.75
Amer. Metal, pfd.	New York	119¾	117¼	117½	Fe.18, Ma.1 Q	1.75
Amer. Sm. & Ref.	New York	182½	170	170	De.31, Fe. 1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	134½	132¾	132¾	De.31, Ma.1 Q	1.75
Consol. M. & S.	Montreal	284½	272	273½	De. 31, Ja. 16 X	6.25
Newmont Mining	N. Y. Curb	170¾	148½	151½	Ja.3, Ja. 17	1.00
U. S. Sm. R. & M.	New York	42¼	40	40	Ja. 6, Ja. 14 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	53½	52¼	52¼	Ja. 6, Ja 14 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED FEBRUARY 7, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Aramayo Mines (25 frs.)	70/3	68/1½	68/9	Feb., 1928	5	p.c. (†)
British Platinum (£1)	—/1½	—/1½	—/1½	Feb., 1925	2½	p.c.
Burma Corpn. (10 rupees)	13 10½	13/—	13/—	Jan., 1928	6	annas*
Bwana M'Kubwa (5s)	4/9	4 1½	4/7½			
Camp Bird (2s)	3/10½	3/7½	3/9			
El Oro (£1)	3/9	3/3	3/6	Nov., 1924	2½	p.c.*
Esperanza (10s)	—/1½	—/1½	—/1½			
Frontino & Bolivia (£1)	14/3	13/9	13/9	Jan., 1928	5	p.c
Mexican Corpn. (£1)	8/6	8/—	8/6			
Mexico Mines of El Oro (£1)	25/7½	22/6	23/9	Dec., 1926	3¾	p.c.*
N'Changa Copper Mining	11/—	10/3	10/6			
Oroville Dredging (£1)	4/4½	3/10½	4/3	Dec., 1923	3¾	p.c.
Ouro Preto (£1)	2/6	2/3	2/3	May, 1925	2½	p.c.
Rhodesian Congo Border (£1)	26/7½	21/3	22/6			
St. John del Rey (£1)	10/3	9/9	10 3	May, 1927	3¾	p.c
San Francisco Mines (10s)	27/4½	25/9	26/3	Jan, 1928	25s.	
Santa Gertrudis (£1)	15/7½	15/1½	15/3	Jan., 1928	7½	p.c.
Selukwe (2s. 6d.)	7/3	6/3	7/—	April, 1917	6¼	p.c.
S. Amer. Copper (2s.)	—/7½	—/1½	—/6	Nov., 1917	75	p.c
Tanganyika (£1)	73/6	66/3	67/6	Aug., 1927	7½	p.c.
Union Miniere du Haut-Katanga (Brussels)	12.200	11.000	11.000	July, 1927	182.60	(‡)

* Free of British income tax. † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

Current Prices of Mining Supplies

Rise and Fall of the Market

PRICES of mining supplies show marked upward tendencies, compared with levels of a month ago. Principal among the materials affected are: cast-iron pipe, lumber, paint stuffs and steel. Manila rope declined 1½c. per lb. in Chicago, Minneapolis, Denver and Kansas City, Mo., during the last month. Steel structurals hold at the January price of $1.85 per 100 lb. in carloads, f.o.b. Pittsburgh; the December quotation was $1.80.

SHEETS—Quotations are per 100 lb. in various cities from warehouse, also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Galvanized No. 24	$3.65@$3.75	$5.25	$4.80	$5.35	$4.95

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh, Chicago and Birmingham for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh or carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.70@$2.80	$2.80–$2.90	$3.55	$3.65	$3.85	$3.00
Track bolts	3.80	3.90@4.25	4.55	4.65	5.35	3.90
Standard section angle bars, splice bars or fish plates	2.75	2.85	3.40	4.25	4.25	2.95

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in carload lots, f.o.b. Pittsburgh mill, and Birmingham. At other cities listed, quotations apply on less-than-carload lots, from warehouses.:

	Pittsburgh, Mill	Birmingham	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.85	$1.90@$2.00	$3.34	$4.00	$3.25	$3.10	$3.15
Channel, 3 to 15 in.	1.85	1.90@ 2.00	3.34	4.00	3.25	3.10	3.15
Angles, 3 to 6 in., ¼ in. thick	1.85	1.90@ 2.00	3.34	4.00	3.25	3.10	3.15
Tees, 3 in. and larger	1.85	1.90@ 2.00	3 34	4.00	3.35	3.10	3.15
Plates ¼-inch thick	1.85	1.90@ 2.00	3.34	4.00	3.25	3 10	3.15

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope (*add to list*)	12½%

	New York	Cleveland	Chicago
DRILL ROD (from list)	60%	55%	50%

WROUGHT IRON AND STEEL PIPE—The following discounts from list are to jobbers for carload lots at Pittsburgh mill:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD—	..1 to 3	62	50½	1 to 1½	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

WROUGHT-STEEL PIPE—From warehouses at the places named the following discounts from list hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in., lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices on class B and heavier, f.o.b. per net ton, for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$37.60	$48.60	$28.00	$36.20	$33.60	$39.00

NUTS—Hot pressed or cold punched, square or hexagonal, blank or tapped, up to 1-in., inclusive, full packages, discount 55% from new list, April 1, 1927, at warehouses in New York and vicinity.

HOLLOW TILE—Price per block in carload lots, f.o.b., to contractors, for hollow building and partition tile.

	New York Current on Trucks‡	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco‡	Perth Amboy N. J., Factory
4x12x12	$0.0966	$0 1027	$0.076	$0.105	$0.068	$0.108	..
6x12x12	.145	1541	.104	....	.09	.156	$0.2432*
8x12x12	.1812	1926	.142	.21	.126	.244	.3311†

* 10x12x12; † 12x12x12. ‡ Partition tile

MACHINE BOLTS—Square heads and nuts, up to 1x30-in.; full packages, discount 50% from new list, April 1, 1927 at warehouses in New York and vicinity.

LUMBER—Prices wholesale, per M ft. b.m., in carload lots, f.o.b. San Francisco—At yards, rough Douglas fir, No. 1 common:

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft
3x3 and 4	$29.00	$30.00	$31.00	$34.00
3x6 and 8	29.00	30.00	31.00	34.00
4x4-6 and 8	29.00	30.00	31.00	34.00

New York—Prices are for long-leaf yellow pine timbers (rough) to dealers alongside dock. Price to contractors, delivered to job, is $5@$10 additional:

	New York 20 Ft and Under	New York 22-24 Ft.	Chicago Up to 20 Ft., Pine	Chicago Up to 32 Ft., Fir*
3x4 to 8x8	$41.00@43.00	$42.00@44.00	$38 00	$39 50
3x10 to 10x10	48.00@50 00	49.00@51.00	45 00	39.50
3x12 to 12x12	55.00@57.00	56.00@58.00	55.00	39.50

Other Cities—Prices are for rough timbers:

	8 x8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In.‡ 20 Ft. and Under Pine	Fir*
Boston	$48.00	$47.50†	$49.00	$52.00	$57.50	$57.00
Cincinnati	33.00	46.00	44.00	44.00	37 00	50.00
Denver		32 75	32 75	32.75	33.75	33 75
Minneapolis	44 25	37.75	36.25	.....	48 25	38.25
Kansas City, Mo.	40 50	38.75			54 50	38 75
Philadelphia	48.00	35.00	40 00	45.00	60.00	35.00

*Douglas fir. †Prime. ‡3x12 to 12x12 Chicago S4S.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	2.55	$2.95	$3.25	$4.25	$2.83	$4.95
Cut	2.80	....	4.90	5.00	2.88	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without charge for bags.* Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.25@$2.35	$2.25@2.35	$2.35 2.50
Chicago, f.o.b.	2.05	2.05	2 05
Cleveland, f.o.b.	2.24	2.24	2.24

LIME—Warehouse; New York quotes bbl. 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$17.20@18.20	$12 10	$3.25@3.50	$2.10@2.50
Chicago	20.00	18.00	....	1.50

LINSEED OIL—These prices are per 7½-lb. gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.76½	$0.81	$0.78	$0.84

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	13.75	15.25	15.25	16.75
White	13.75	15.25	13.75	15.25

HOSE—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket (net) ..... $0.68 per ft.

Air—Best Grade
½-in., per ft. ..... 3 ply $0.36½ 4 ply $0.44

Steam—Discounts from List
First grade ... 30–10% Second grade ..... 40% Third grade 45%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting. Discounts from list are as follows:
Best grade ..... 45% Second grade 50%

LEATHER BELTING—List price, 24c. per lin.ft., per inch of width, for single ply at New York warehouses:

Grade	Discount from list
Medium	35%
Heavy	30%

PACKING—Prices per pound at New York warehouses:

Rubber and duck for low-pressure steam, ½ in.	$0.95
Rubber sheet	.50
Rubber sheet, wire insertion	.80

MANILA ROPE—Per lb., ½-in. and larger, 1,200-ft. coils:

Atlanta	$0.22	New Orleans	$0.23½
New York	.26	Seattle	.23
Chicago	22	San Francisco	.23

EXPLOSIVES—Prices per pound for dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.265	$0.2875
Minneapolis	.1917	2123
Denver	.2025	2275
Seattle	.165	19
Cincinnati	22	245
San Francisco	.1625	.1925

FLOTATION OIL—Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.33

CHEMICALS—Prices for round lots in New York market, per lb.:

Zinc dust, 550 lb. casks	$0.09@.10
Litharge, casks	.09
Sodium cyanide, 220 lb. single case lots	.18@.22
Calcium carbide, in drums	.05@.06